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MAIZE AND FINGERMILLET

THE TWELFTH SUMMER CROPS WORKSHOP 1985

HIS MAJESTY'S GOVERNMENT
DEPARTMENT OF AGRICULTURE
NATIONAL MAIZE DEVELOPMENT PROGRAM
RAMPUR AGRICULTURE STATION
RAMPUR, CHITWAN, NEPAL

January 28 - February 1, 1985

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Coordinator's Report, 1984

Vishnu P. Sharma*

Maize is the second most important cereal crop of Nepal and the main staple food of hills. The estimated area under maize in Nepal is 503,770 ha with an average production of 1.511 t/ha. The distribution of hectareage is 41,200 ha (8.2 %) with an average production of 1.426 t/ha in high hills, 317,450 ha (63.0 %) with an average production of 1.378 t/ha in hills and 145,120 ha (28.8%) with an average production of 1.825 t/ha in tarai. The total production of maize is estimated to be 761,110 t. (Source : Food and Agricultural Marketing Services Department, HMG).

The maize yield is declining every year. This decline is attributed to several reasons but some of the main reasons are soil erosion and subsequent decrease in soil fertility due to top soil removal, unfavourable weather conditions causing extreme soil moisture regime and pest and disease incidence. However, the performance of winter maize in tarai districts and spring maize in tarai and foot hills and river basins of hill districts under full and/or partial irrigation is quite encouraging. This is the season when maize is grown with better management and inputs.

The crop has been experiencing very unfavourable weather during the crop season at NMDP, Rampur for the last 4 years. The last monsoon crop suffered because of late rain at the time of sowing and later due to excessive soil moisture caused by heavy rain. Because of this, the crop was planted late, could not be weeded properly, the plant stand and growth was reduced. The winter crop also suffered due to unfavourable moisture regime. Planting was delayed due to heavy rain in early September and later prolonged drought severely affected the crop.

In general, monsoon maize in hills was affected due to late rain. Some districts such as Gorkha, Tanahun, Lamjung, Kaski and Syangja reported heavy incidence of army worm (Mythimna separata). Stem borer (Chilo partellus) infestation was also reported from Lamjung district. Brown stripe downy mildew was reported from Gorkha and Kaski districts.

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Minikits:

Confidence of the farmers on the effectiveness of the maize minikits is increasing. In 1984, five thousand two hundred maize minikits were distributed to the farmers of 53 districts through the respective Agricultural Development Offices and only 900 response cards have been received so far.

The performance of maize minikits is given below:

Grain Yield (kg/ha) Obtained from Maize Minikits*

Year	National Average (kg/ha)	Average Production from Minikits				
		Eastern Region	Central Region	Western Region	Mid and Far Western Regions	Overall Average
1978	1664	2854	2304	2960	2830	2862
1979	1635	2658	2648	2637	3271	2804
1980	1281	2845	2775	3080	2528	2807
1981	1629	2261	3039	2896	2330	2507
1982	1581	2384	2574	2562	2440	2490
1983	1535	2160	1730	2060	1980	1983
1984	1511	1723	1163	3093	1495	1869
Mean	1548	2412	2390	2755	2411	2492
Increase Over National Average (%)		55.8	54.4	78.0	55.7	61.0

* - Average of 2341, 1904, 1325, 1282, 1053, 1583 and 900 response cards from 1978 to 1984 respectively.

The maize minikits are being distributed since 1978. These minikits have become an effective tool in dissemination of improved varieties and demonstration of the effects of superior variety, fertilizer nutrients, plant protection and better management. Return of feed back information, however, is not satisfactory and hence I request fellow agricultural extension officers to pay a little more attention in returning back properly filled response card to NMDP so that an effective evaluation of the varieties and the other technologies could be done for further improvement of the program.

Distribution of maize minikits in 1984 and the response card received by NMDP by development zones are given below:

Minikits Distributed Monsoon -	1075	1200	1075	600	250	4200
Spring -	325	350	275	50	-	1000
Total	1400	1550	1350	650	250	5200
Response Card Received						
Monsoon -	374	195	143	100	-	812
Spring -	34	22	32	-	-	88
Total	408	217	175	100	-	900

Research Activities:

One of the objectives of NMDP is to develop new maize varieties suitable for different agroclimatic regions of the country. We have developed several new materials, some of them are Ganesh-2 (for high-hills), Manakamana-2 (for hills), Rampur-1 and Rampur-2 (for tarai), Manakamana-1 (for hills in monsoon and for tarai in winter) and Arun-1 and Arun-4 (early maturing for hills and tarai). Manakamana-1, Manakamana-2, Rampur-2 and Arun-4 may be released next year as their performance is quite encouraging. These varieties will meet most of the farmers requirements like earlyness, colour preference, adaptability, higher tolerance level to different cropping hazards and higher grain yield. Makalu-2 (Amarillo del Bajio) has been released on May 4, 1984 by Central Seed Release Committee for Pakhribas and Dumle Agricultural Centres command areas.

Because the weather last year was unfavourable very few trials and studies could be completed.

Different varieties tested at 9 different locations (mostly hills) during monsoon did not differ significantly with each other probably due to erratic soil moisture regime which caused higher experimental error. Based on grain yield data averaged over all the locations, Pioneer 6181 (3947 kg/ha) and Rampur-2 (3679 kg/ha) yielded significantly higher than the farmers variety (2992 kg/ha).

Genotypes Manakamana-1, Manakamana-2 and Arun-2 did not differ significantly with Pioneer 6181 and Rampur-2. Arun varieties were the earliest in maturity followed by farmer's variety. Rest of the genotypes were similar in maturity.

Effect of conventional, minimum and zero tillage with and without mulch on monsoon maize studied at Rampur failed to show any significant effect of tillage system and/or mulch (wheat straw) on the grain yield.

Fertilizer trial conducted on early maize varieties Arun-1, Arun-2 and Arun-4 in farmers field in Chitwan was inconclusive. However, economic analysis considering the price of N and its application cost as variable cost, showed 73% and 60 % marginal rate of return at 50 and 100 kg N/ha, respectively, and 150 kg N/ha treatment was dominated. This indicates that higher MRR is obtained at lower N levels and that economic dose of N is not probably not more than 100 kg N/ha.

In a study to determine the yield loss in maize due to second instar stem-borer larvae (Chilo partellus) attack under artificial infestation showed that even a single larva caused 58 % reduction in yield and this reduction increased with increase in larval population.

In fingermillet studies at Rampur, genotypes NE 1704-2, NE 1305-46 and NE-52 were the top yielders in Initial Evaluation Trial whereas in Advanced Varietal Trial, Rampur Local was the highest yielder.

Fertilizer trial with fingermillet showed a positive response up to 40 kg N/ha, the highest N level tested.

Date of transplanting trial on fingermillet indicated the 3rd week of August (first week of Bhadra) transplanting to be the best for high yield.

Seed Multiplication:

A total of 11400 kg of maize foundation seeds was provided to AIC for certified seed multiplication last year.

Tour, Training and Visits:

Mr. K.K. Lal completed his Ph.D. from Kansas State University. Mr. K.P. Koirala and Mr. I.B. Chaudhary left for the Philippines and India, respectively,

to complete their M.S. Mr. G.P. Shivakoti, Assistant Entomologist, NMDP, received Andre Myer Fellowship to continue study on stored grain insect pest in Mexico and is already there continuing his research. Dr. Carl N. Hittle, Project Supervisor, ICP, and I accompanied Mr. P.P. Gorkhali, DG, Department of Agriculture on a trip to Farming System Workshop in Kansas State University and then to CIMMYT, Mexico, where useful discussions were held with the concerned scientists.

Dr. B.L. Renfro, Pathologist, CIMMYT Bangkok and Dr. C. Chutkaew, Kassetsart University, Bangkok visited Nepal for maize disease study. The team found Brown Stripe Downy Mildew in Arun-2 and Manakamana-2 in Kaski district and in Manakamana-1 in Gorkha district.

In country, monitoring tours were organized and NMDP/RAS officers monitored maize and fingermillet crops in Dang, Salyan, Pyuthan, Gorkha, Lamjung, Tanahun, Syangja, Dhankuta, Terahthum and Sankhuwasabha districts.

Future Plan:

The Seventh Plan begins with F.Y. 1985. The present area under maize is estimated to remain constant upto the end of the Seventh Plan (503,770 ha). It has been planned to increase the present total maize production from 761.110 t. (productivity 1.511 t/ha) to 916.085 t. (productivity 1.815 t/ha) by the end of the Seventh Plan. It is envisaged to attain this goal through effective implementation of special, pocket and general production programs.

Maize Production Target, Seventh Plan 1985 - 1990:

Description	Total	Special Program	Pocket Program	General Program	Rest of the Area
FY 1985-86(Area/ha)	503770	13642	13598	99885	376645
Production (t)	805300	40926	25836	169804	568734
Productivity (t/ha)	1.599	3.0	1.9	1.7	1.51
FY 1986-87 Area(ha)	503770	17051	23820	129277	333622
Production (t)	827035	54562	47640	227064	503769
Productivity (t/ha)	1.642	3.2	2.0	1.71	1.51
FY 1987-88 Area(ha)	503770	20462	34059	158641	290608
Production (t)	852775	69571	71524	272	438818
Productivity (t/ha)	1.693	3.4	2.1	1.72	1.51
FY 1988-89 Area (ha)	503770	23874	44324	187674	247898
Production (t)	882462	85947	97513	324676	374326
Productivity (t/ha)	1.752	3.6	2.2	1.73	1.51
FY 1989-90 Area(ha)	503770	27284	54594	216447	205445
Production (t)	916085	103679	125566	376618	310222
Productivity (t/ha)	1.815	3.8	2.3	1.74	1.51

Special program will cover winter maize area in tarai, areas of tarai and foot hills where maize is sown in January - February and spring maize (after winter crop) area.

Pocket program will be implemented in monsoon maize grown in hills and tarai where transportation and other facilities are available. General program will cover monsoon maize grown in potential areas of hills.

To obtain the proposed production target, use of suitable variety, plant protection measures, effective use of fertilizer nutrients, use of improved seed. Availability of production loan and effective technical support have been suggested.

Problem in maize marketing has been a problem in some maize growing areas because of non maize eating habit of the area. To achieve the targeted production, proper market facilities are necessary. The present trend of 97%

consumption as food also needs to be changed to higher use in industries which is almost nill at present.

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NMDP is very much grateful to the Ministry of Agriculture, Department of Agriculture, Regional Agricultural Directorates, Technical Divisions, Agricultural Stations / Farms, Agricultural Development Offices, Agricultural Development Bank, Agricultural Input Corporation and other agencies for their active and sincere cooperation and assistance to run the program successfully. NMDP also expresses its sincere thanks to IADS/ICP, USAID, CIMMYT and other organizations who in one way or the other have helped to run the program smoothly.

Last but not least, NMDP expresses its thanks to its former Coordinator, for his untiring effort in developing NMDP to the present status.

Discussion on Maize Coordinator's Report

P.N. Rana : Collection and compilation of information on minikits is very important. People involved in minikit distribution to the farmers should be made responsible for proper filling of minikit feed back cards.

S.L. Shre-stha : Is the fertilizer response of fingermillet economically viable ?

At Chauri Jahari, Rukum district, farmers follow direct seeding of fingermillet and till now only local cultivars are in use. Do we have any thing to recommend to these farmers ?

Sharma : Economic analysis of the trial has not been performed and hence it is very difficult to say any thing about the economics.

We are testing fingermillet cultivars in traditional way by transplanting. Any cultivar should perform well under direct seeding conditions also provided weeds don't dominate.

D.B.Tamang: Rampur Local fingermillet variety needs further selection works with a view to strike the balance between synchronous maturity and final yield of the crop.

Sharma : Thanks for the suggestion but simple selection will not be effective as it is self pollinated crop.

P.P.Sharma, IAAS: Would it be possible to mention on IAAS / NMDP collaborative research on four tillage systems X 3 N levels on maize at two sites - one each at NMDP and IAAS ?

Sharma : Thanks for the information of the house I read it.

P.L. Chi-Trakar : What could be the reason reactions for decreasing the yield of minikits in the years 1983 and 1984 compared to 1978 - 1982 ?

Sharma : Drought at the time of planting for monsoon and late rain causing drought in spring maize.

Dr. G.L. Shrestha : During last 5 - 10 years, the productivity of maize has come down from 1664 to 1511, and in the coming 7th five year plan it will be raised to 1.8 t in total (1985-1989). May I know there will be any special effort on reversing this productivity trend and increase the total production?

Sharma : In Seventh Plan.

Dr. N.K. Mishra : On the basis of Tillage levels trial's results on maize - Do you recommend that the concept of minimum/zero tillage may be applicable by Chitwan farmers. What about the weed intensity - under cliff tillage system - ? If recorded please elaborate.

Sharma : Study is in preliminary stage in Nepal.

R. Chaudhary : 1. What is present productivity of special program ?
2. Do you think that in the end of 7th five year plan, maize productivity will go up from 3.0 t/ha to 3.8 t/ha in special program. Please comment.

Sharma : Please refer the chart.

Jagdish Timsina
IAAS, Rampur : I came to know from your report that you are not doing any intercropping experiments on maize with other suitable intercrops and you don't have any future plan on this line. Don't you think that intercropping involves intensification in both space and time and thus can meet food requirements of Nepalese farmers ? What can you say about this ?

Sharma : We have been doing intercropping trials in past, but there was no study last year due to local weather condition.

Report On NMDP Varietal Trial, 1984

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ABSTRACT

The objective of this study was to find out the superior maize genotypes for different agroclimatic regions of the country. Twelve maize genotypes including four checks were tested at nine locations during summer 1984. The new genotypes tested gave encouraging results and were equally competitive and even better than the hybrid in many cases. These seven genotypes (populations) are not the final varieties yet; they are still in development and evaluation stages. The results for many locations are not significant and the high percentage of C.V. indicates the need of increase of precision in the experiment. However, the early maturity genotypes, Arun-1 and Arun-4, competed with Arun-2. These were shorter in plant height and early in maturity. Among the full season genotypes, Manakamana-2, Manakamana-1, Rampur-2 and Poineer 6181 do not differ significantly for yield. Highest yield was obtained from Poineer 6181 followed by Rampur-2. These two genotypes were significantly superior to farmer's variety. Plant height of improved genotypes was shorter than farmer's variety, however, some of the genotypes need to be further improved for plant height, husk cover, maturity, lodging etc.

MATERIALS AND METHODS

This trial was conducted at Lumle (1520 m), Pakhribas north (1800 m), Pakhribas south (1227 m), Kabhre (2003 m), Kakani (1858 m), Khumaltar (1360 m), Tarahara (1200 m), Surkhet (670 m) and Doti (1360 m) during summer 1984. Unfortunately, the trials at Rampur and Nepalgunj were failed because of unfavourable weather. Data from IHDP, Kakani, Hardinath, IRDP and Jumla have not received yet. Out of twelve genotypes, Ganesh-2, Manakamana-2, Manakamana-1, Rampur-2, Rampur-1, Arun-4 and Arun-1 are newly developed populations. These seven genotypes and Poineer 6181 hybrid were evaluated with Khumal Yellow, Rampur Composite, Arun-2 and farmer's variety as checks.

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A Randomized Complete Block Design (RCBD) with these twelve genotypes and four replications was used; and the experimental design and genotypes were the same for each location. Six rows (3 m long) per plot for hills and four rows (5 m long) per plot for tarai were planted. Row and plant spacings were 75 cm and 25 cm respectively. The data were taken from the central rows. Grain yield was adjusted at 15% moisture and only this trait was analyzed statistically. The results are given in Table Nos. 1 to 5.

RESULTS AND DISCUSSION

Mean yield for each location and average over locations are given in Table-1. The performance of the entries were not consistent across the locations. The genotypes differed significantly only at Pakhribas south, Khumaltar and Surkhet. At Pakhribas south Poineer-6181 yielded the highest and followed by Arun-2, Rampur Composite, Rampur-2, Arun-4 and so on. All the genotypes were superior to farmer's variety at this location. At Khumaltar also Poineer-6181 gave the highest yield followed by Manakamana-2, Rampur-2, Manakamana-1 and Rampur Composite. Manakamana-2 and Rampur-2 were statistically superior to Arun-2 and farmer's variety. The mean yield averaged over locations showed that Poineer-6181 gave the highest yield followed by Rampur-2, Manakamana-1, Manakamana-2 and farmer's variety gave the lowest yield. Poineer 6181 and Rampur-2 gave significantly higher yield than the farmer's variety.

Days to 50% silking and plant height in cm are presented on Table-3. As expected Arun-1, Arun-2 and Arun-4 were earlier genotypes as compared with others and Arun-1 and Arun-4 were in the same maturity range as Arun-2. Rampur-1 took the longest duration (83 days) for 50% silking and other full season genotypes are slightly late as compared with the farmer's variety (Table-3). So far as plant height is concerned Poineer 6181 is the shortest one and Arun-4 and Arun-1 were shorter than the four checks. Farmer's variety was the tallest one and other five genotypes were medium in plant height.

The root and stalk lodging percentages were highest in farmer's variety and Poineer-6181 seems to have no serious lodging problem (Table 4). With some exception of locations (Kakani, Surkhet and Pakhribas south), there was no serious problem of lodging in the new genotypes. The percentages of husk cover and cob rot are given in Table 5. Farmer's variety had better husk cover as

compared with all other genotypes, whereas farmer's variety, Manakamana-1, Rampur 2, and Rampur Composite had low cob rot problem. In Kakani and Kabhre cob rot seems to be the major problem.

ACKNOWLEDGEMENTS

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Table - 1

GRAIN YIELD KG/HA

Locations / Genotypes	Lumle	Pokhribas (North)	Kabhre	Kakani	Pokhribas (South)	Khumal	Tarahara	Surkhet	Doti	Mean
1. Ganesh-2	4276	2268	3875	2224	2777	4627	2057	5825	2480	3379
2. Manakamana-2	3706	2962	2602	2345	2800	5981	2422	5835	2490	3460
3. Manakamana-1	3281	2557	4376	2474	2396	5036	2838	5067	3234	3473
4. Rampur-2	3933	2784	2725	2224	3053	5797	2672	5895	4027	3679
5. Rampur-1	3136	2083	2429	1622	2807	3840	2243	5259	3827	3027
6. Arun-4	4487	2707	2539	1449	3020	4293	1999	5061	3200	3201
7. Arun-1	3592	2734	2341	1380	2968	3964	2112	5703	3173	3108
8. Pioneer-6181	4146	3324	3638	2121	3616	6361	2887	5927	3507	3947
*9. Khumal yellow	3281	2228	4043	2366	2916	4597	2269	5122	3333	3351
10. Rampur Composite	3758	2665	2361	2494	3056	4862	2637	4559	3747	3349
11. Arun-2	4380	2641	2585	2388	3518	4485	2709	5217	2960	3431
12. Farmers'Variety	3719	2287	2619	2365	1533	4581	1850	4908	3067	2992
L.S.D. 5% kg/ha	NS	NS	NS	NS	576	1178	NS	1100	NS	530
C.V. %	20	22	30	27	14	17	24	14	41	13

* In case of Pachribas No. 9 entry is Hetauda Composite.

Table -2

PLANTS/HA (1000 PLANTS)

Locations / Genotypes	Lumle	Pakhribas (North)	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarahara	Surkhet	Doti	Mean
1. Ganesh-2	93.3	50.0	41.3	37.8	47.8	46.7	35.0	47.7	76.0	52.8
2. Manakamana-2	73.3	43.9	44.0	42.2	51.1	52.0	40.0	44.4	73.3	52.1
3. Manakamana-1	103.3	48.9	35.7	38.9	45.9	44.0	41.7	41	82.7	54.7
4. Rampur-2	100.0	50.0	48.0	44.4	51.1	49.3	35.0	46.0	81.3	56.1
5. Rampur-1	106.7	47.8	41.3	38.9	48.9	46.7	40.0	44.4	78.7	54.8
6. Arun-4	103.3	52.2	34.7	31.1	52.2	45.7	35.0	44.4	86.7	53.8
7. Arun 1	93.3	47.8	37.3	31.1	50.0	49.3	40.0	49.0	80.0	53.1
8 Pioneer-5181	100.0	47.8	42.7	37.8	51.1	45.3	41.7	49.0	86.7	55.0
*9. Khumal Yellow	90.0	51.1	48.0	37.8	36.7	49.3	41.7	44.4	88.0	54.1
10. Rampur Composite	96.7	51.1	38.7	43.3	47.8	44.0	40.0	41.4	90.7	54.9
11. Arun-2	80.0	52.2	42.7	35.6	52.2	45.3	41.7	43.0	85.3	53.1
12. Farmers' Variety	103.3	45.6	38.7	43.3	36.7	50.7	31.7	46.0	53.3	50.0

* In case of Pakhribas No. 9 entry is Hetauda Composite.

Table- 3

Genotypes \ Locations	Days to 50% silking									Plant height in cm.								
	Lumle	Pakhribas	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarahara	Surkhet	Doti	Mean	Lumle	Pakhribas (North)	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarahara	Surkhet	Doti	Mean
1. Ganesh-2	96	95	68	103	79	74	62	61	53	77	219	227	225	126	240	194	175	259	229	210
2. Manakamana-2	96	94	69	115	80	72	63	56	55	78	209	215	176	141	237	193	155	255	212	199
3. Manakamana-1	96	98	75	112	87	74	64	61	54	80	229	219	183	142	241	191	170	241	213	203
4. Rampur-2	90	94	82	124	77	70	62	58	54	79	218	224	189	122	228	192	158	243	223	200
5. Rampur-1	96	96	91	123	85	76	64	59	55	83	231	218	211	126	238	191	174	250	217	206
6. Arun-4	78	86	84	108	71	67	56	56	50	73	196	201	156	105	199	181	155	233	218	183
7. Arun-1	78	87	78	102	70	66	55	54	51	71	206	201	146	113	207	189	149	240	225	186
8. Pi[illegible]r-6181	96	96	88	119	81	74	64	60	56	82	203	191	173	119	199	172	168	196	187	180
9. Khumal Yellow	90	98	84	114	85	73	63	61	55	80	220	224	192	134	269	183	171	146	228	207
10. Rampur Composite	88	94	87	114	79	73	63	61	55	80	246	227	160	134	231	182	163	219	226	199
11. Arun-2	77	84	79	101	71	64	55	56	52	71	209	203	188	129	224	189	164	236	215	195
12. Farmers' Variety	80	96	76	116	89	71	64	60	36	76	241	299	204	174	304	185	165	282	251	234

* In case of Pakhribas No.9 entry is Hetauda Composite.

Table 4:

Locations/ Genotypes	Root lodging %										Stalk lodging %									
	Lumle	Pakhribas (North)	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarhara	Surkhet	Doti	Mean	Lumle	Pakhribas (North)	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarhara	Surkhet	Doti	Mean
1. Ganesh-2	2	1	13	7	5	10	12	23	7	9	0	6	12	5	29	5	14	1	-	9
2. Manakamana-2	1	0	6	8	3	3	9	21	9	7	0	1	0	4	19	1	11	7	-	5
3. Manakamana-1	1	0	9	4	11	3	6	23	7	7	0	3	0	1	20	3	8	7	-	5
4. Rampur-2	1	0	10	3	2	13	7	20	4	7	0	3	3	4	9	3	7	3	-	4
5. Rampur-1	0	3	10	4	16	3	2	27	11	8	0	4	2	3	16	1	7	3	-	5
6. Arun-4	1	1	10	17	5	8	13	12	7	8	0	1	0	6	17	9	15	8	-	7
7. Arun-1	1	0	4	15	5	5	5	9	13	6	0	0	2	9	27	9	15	2	-	8
8. Pioneer-6181	0	0	8	8	5	1	4	6	6	4	0	0	0	4	7	0	5	0	-	2
9. Khumal Yellow*	4	3	2	10	13	9	13	26	5	9	0	8	3	4	27	3	5	3	-	7
10. Rampur Composite	1	0	10	5	0	9	2	29	5	7	0	4	2	4	30	0	2	4	-	6
11. Arun-2	0	2	6	8	5	4	7	25	7	7	0	1	2	10	20	9	10	4	-	7
12. Farmer's Variety	8	3	7	8	10	13	15	21	38	14	0	4	5	11	80	3	11	3	-	15

* - In case of Pakhribas No. 9 entry is Hetauda Composite.

Table- 5

Locations / Genotypes	Husk Cover %ge									Diseased ear %ge									
	Lumle	Pakhribas (North)	Kabhre	Kakani	Pakhribas (South)	Khumal	Tarahara	Surkhet	Doti	Mean	Lumle	Pokhribas (North)	Kabhre	Kakani	Pokhribas (South)	Khumal	Tarhara	Surkhet	Doti	Mean
1. Ganesh-2	2	9	27	-	23	4	11	18	-	13	-	4	21	30	2	4	5	0	-	9
2. Manakamana-2	2	13	12	-	25	6	9	20	-	12	-	2	10	23	2	7	3	0	-	7
3. Manakamana-1	4	19	16	-	17	8	10	6	-	11	-	1	8	12	1	2	5	0	-	4
4. Rampur-2	1	9	5	-	34	7	11	6	-	10	-	1	10	25	0	3	6	0	-	6
5. Rampur-1	4	23	13	-	50	14	15	18	-	20	-	2	14	23	3	5	11	0	-	8
6. Arun-4	2	11	6	-	26	10	16	25	-	14	-	5	12	39	3	4	16	0	-	11
7. Arun-1	1	15	4	-	26	10	15	17	-	13	-	3	8	39	2	7	12	3	-	11
8. Poineer-6181	3	15	14	-	28	15	9	9	-	13	-	1	19	27	0	8	1	0	-	8
*9. Khumal Yellow	0	12	6	-	16	4	17	17	-	10	-	2	25	31	1	6	4	3	-	10
10. Rampur Composite	2	12	12	-	28	9	16	12	-	13	-	3	11	20	0	5	3	0	-	6
11. Arun-2	2	16	9	-	27	9	12	16	-	13	-	2	14	36	3	8	12	1	-	11
12. Farmers'sVariety	0	0	5	-	3	5	15	3	-	4	-	0	0	6	1	8	4	2	-	3

* In case of Pakhribas No.9 entry is Hetauda Composite.

Genotype X Environment Interaction And Stability Parameters For Yield And Other Agronomic Traits Among Corn Composites in Nepal

K.K. Lal*

ABSTRACT

Nine corn composites grown at seven different locations in Nepal in 1982 and 1983 were studied to evaluate their yield performance in terms of stability and potential yield. A statistical model developed by Eberhart and Russell was utilized for computation of three parameters, mean yield, regression coefficient, and deviation from regression. These parameters were considered jointly in determining yield performance of new genetic sources which were being considered for release in Nepal for commercial production.

The combined analysis of variance exhibited highly significant first and second order interactions. The stability parameters were used to show the existence of wide genotypic differences in response to environment. The stability parameters computed in this study are useful in describing and predicting genotype performances. Large deviation from regression limited the use of regression coefficients as predictive parameters.

The distribution of genotypes with respect to mean yield and stability parameters depends upon the particular environments considered. Genotypes having higher yield over 14 environments were Manakamana-2, Rampur-2, Ganesh-2 and Khumal Yellow. However, Manakamana-2 and Khumal Yellow had significantly greater deviation from regression. Rampur-2 and Ganesh-2 had higher mean yield, regression coefficients of one and had smaller deviation (near zero) from regression, therefore, were classified as stable genotypes. In contrast, a local cultivar which had low mean yields and highest deviation from regression was designated as the most unstable source. Rampur Composites which had a low mean yield, a regression coefficient significantly less than unity and nearly zero deviation from regression was classified as a genotype suitable for less favourable environmental conditions.

Other agronomic characters such as plant height and days to 50% silking were also evaluated using the Eberhart and Russell model. A wide range of stability parameters were found among the genotypes. Only deviation from regression parameters was considered in this case since means and regression coefficients were nearly the same for all sources. Ganesh-2 was most stable in days to 50% silking. For plant height, Ganesh-2, Khumal Yellow, Rampur Composites, Rampur-1, and Rampur-2 were rated as most stable. Although genotypes showed marked differences in mean performance, they were relatively nonsensitive to environment and the most important stability parameter appeared to be deviation from regression.

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Analysis of Variance of grain yield of Nine Genotypes at Seven Locations in 1982 and 1983 in Nepal

Source of Variation	d.f.	M.S.
Year (Y)	1	618266
Location (Loc.)	6	87001143
Location X Year	6	4796442
Error (a)	28	892538
Genotypes (G)	8	5707857**
G x Y	8	1408715**
G x L	48	2055084**
G x L x Y	48	767913*
Error (b)	224	521169

* - Significant at 5% level.
** - Significant at 1% level.

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Stability Analysis of Variance of Grain Yield of Nine Genotypes at Fourteen Environments

Source of Variation	d.f.	M.S.
Genotypes (G)	8	1902619**
Environments (E)		
G x E	117	2727239
Environment (Linear)		
G X E (Linear)	8	38000847**
Pooled Environment	108	419025**
Deviations		
Error	224	173723

** - Significant at 1% level.

Stability Parameters for Yields of Nine Genotypes

Genotypes	Mean Yield kg/ha			Regression Coefficient	Deviation from Regression
	1982	1983	2-Yr. Ave.	b_1	S^2_d
Arun-2	3419	3856	3637	0.91	192193*
Arun-4	3599	3505	3552	0.98	- 3075
Local Cultivar	3264	2636	2950	1.16	1225848**
Ganesh-2	3791	4158	3974	1.03	32912
Khumal Yellow	3678	4030	3854	1.15	178117*
Manakamana-2	4187	4070	4128	1.07	166816*
Rampur Composite	3295	3759	3527	0.78+	116829
Rampur-1	3539	3410	3502	0.92	301452**
Rampur-2	4019	4149	4084	0.98	- 3578
S.D.			37	0.119	

* - Significant at 5% level.

** - Significant at 1% level.

\+ - Significantly different from unity at the 5% level.

Analysis of Variance of Plant Height of Nine Genotypes At Seven Locations in Nepal in 1982 and 1983

Source of Variation	d.f.	M.S.
Year (Yr.)	1	5053
Location (Loc)	6	26148
Loc X Yr.	6	13083
Error (a)	28	311
Genotype (G)	8	2664**
G X Yr.	8	1205**
G X Loc	48	962**
G X Loc X Yr.	48	504**
Error (a)	224	192

** - Significant at 1% level.

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Stability Analysis of Variance of Plant Height of Nine Genotypes At Fourteen Environments in Nepal

Source of Variation	d.f.	M.S.
Genotypes	8	888*
Environments (E)	117	913
G X E		
Environment (Linear)	1	
G X E (Linear)	8	10354**
Pooled Environment Deviation	108	348**
Error	224	85

* - Significant at 5% level.

** - Significant at 1% level.

Stability Parameters for Plant Height of Nine Genotypes

Genotypes	Main Height (kg/ha)			Regression Coefficient	Deviation from Regression
	1982	1983	Overall	b_1	S^2_d
Arun-2	187	189	188	0.73*	40
Arun-4	187	173	180	0.77	185**
Local Cultivar	191	214	203	1.37	856
Ganesh-2	190	205	197	1.10	-26
Khumal Yellow	199	202	201	1.15	-12
Manakamana-2	192	199	195	0.92	183
Rampur Composite	198	206	202	1.00	- 5
Rampur-1	200	207	204	0.94	0.5
Rampur-2	184	200	192	1.02	4
Mean	192	199	195		
S.D.			11		

** - Significant at 1% level.

Analysis of Variance of 50% Silking of Nine Genotypes At Seven Locations in Nepal in 1982 and 1983

Source of Variation	d.f.	M.S.
Year (Yr.)	1	1326
Locations (Loc)	6	36676
Loc X Yr.	6	291
Error (a)	28	12
Genotype (G)	8	142
G X Yr.	8	6*
G X Loc	48	24*
G X Loc X Yr.	48	10*
Error (b)	224	

* - Significant at the 5% level.

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Stability Analysis of Variance of 50% Silking of Nine Genotypes at Fourteen Environments in Nepal

Source of Variation	d.f.	M.S.
Genotypes (G)	8	258**
Environment (E)	117	662
G X E	1	
Environment (Linear)	8	9225**
G X E (Linear)	108	25**
Pooled Environment Deviation	224	2
Error		

** - Significant at 1% level.

Stability Parameters for 50% Silking of Nine Genotypes

Genotypes	Mean Silking Days			Regression Coefficient	Dev. from Regression
	1982	1983	Overall	b_1	S^2_d
Arun-2	77	79	78	0.92 NS	20**
Arun-4	74	80	77	0.84 NS	65**
Local Cultivar	83	85	84	0.99 NS	92**
Ganesh-2	82	87	84	1.03 NS	1 NS
Khumal Yellow	86	88	87	1.02 NS	6**
Manakamana-2	82	86	85	1.02 NS	7**
Rampur Composite	86	90	88	1.07 NS	8**
Rampur-1	88	90	89	1.06 NS	6**
Rampur-2	81	87	84	1.03 NS	6**
Mean			84		
S.E.			2.3		

** = Significant at 1% level.

NS = Not Significant.

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CIMMYT Experimental Variety Trial - 16 A, 1985

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INTRODUCTION

One of the main functions of maize program is to develop suitable maize genotypes for the different agroclimatic regions of the country. CIMMYT variety trial was conducted with the following two objectives:

1. If the exotic germplasms are proved to have superior traits, they will be incorporated in our breeding program, and

2. If the exotic germplasms are superior to the local and released varieties, they will be tested in different locations and released without any improvement.

MATERIALS AND METHODS

Experimental Variety Trial-16A (EVT-16A) was obtained from CIMMYT, Mexico and this trial was conducted at Khumaltar during summer season 1984. This trial consists of fifteen entries. The recommended varieties Khumal Yellow, Rampur Composite and Arun-2 were used as checks. The rest 12 exotic genotypes were described as sub-tropical to temperate in adoption, intermediate to early in maturity and medium to short in plant height.

A randomized complete block design with these fifteen genotypes and four replications was used. Gross plot size was 4 rows of 5 metre long. Row to row and plant to plant spacings were 75cm and 25 cm respectively. Level of fertilization was 120 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha along with 20 kg/ha $ZnSO_4$. In addition, 20 kg/ha of BHC dust was also applied. Observations were taken for yield, days to 50% silking, plant and ear height, root and stalk lodging, husk cover and occurrence of different diseases. All the data were recorded from the two centre rows only. Grain yield was adjusted to 15% moisture and analyzed statistically. Again, data for days to 50% silking, plant and ear height were also analyzed.

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RESULT AND DISCUSSION

The data of different traits are presented in Table-1. There was significant difference in yield among different genotypes. Guaira 8045 gave the highest yield, however, three checks were at par with it. Tlaltizapan 8146 was inferior to Arun-2 and, other low yielding genotypes were at par with the checks.

The F-test of days to 50% silking is highly significant. The genotypes Tlaltizapan 8146, Coimbatore 8146, Across 8146 and Across 7748 RE were earlier even than the early check Arun-2. Other six exotic genotypes were at par with Arun-2 for maturity and slightly earlier than Khumal Yellow and Rampur Composite. Tlaltizapan 8146 had the shortest plant and ear height, and it was superior to the three checks. Across 8033, La Molina 8146, Pirsabak 8146, Coimbatore 8146 and Across 8148 also were shorter in plant and ear height.

No root lodging was observed in Tlaltizapan 8146 and Pirsabak 8146, however, stalk lodging was a common problem for all genotypes. All the genotypes, including the three checks, showed high percentage of bare tip ear. If this problem is serious, Nepalese farmers will not accept such varieties. None of the exotic genotypes was superior to the three checks for cob rot problem. Although, the checks had high percentage of bare tip ears, they seem tolerant to cob rot problem. The occurrence of rust was same in all genotypes. This year, the infection of Northern corn leaf blight, caused by Helminthoporium turcicum, was heavy in Khumaltar. The level of infection of this disease was higher in all the exotic genotypes than that of Arun-2 and Rampur Composite.

In conclusion, exotic genotypes were not superior to checks for grain yield. But some of them were earlier and shorter, and had no lodging problem. If this is confirmed by further testing, we can use them in our breeding program.

Table 1: The Agronomic Trials of the Genotypes included in the EVT 16A

Location: Khumaltar
Planting Date: May 22,,1984
Harvesting Date: September,12 1984

Entry No.		Yield (kg/ha)	Planting ha (in'000)	Days to 50% silking	Height in cm		Lodging %		Open Husk Cover%	Cob pot %	Disease	
					Plant	Ear	Root	Stalk			Rust	H.turcicum
01	Sete Lagoas 8033	7365	58.3	58	222	108	2.0	8.0	26.0	19.8	1.5	1.8
02	La Molina(1)8033	6104	55.8	57	218	103	1.0	10.3	43.5	22.8	1.4	2.4
03	Across 8033	5004	52.7	58	201	92	4.8	7.0	41.0	23.8	1.5	1.6
04	Suaira 8045	7922	56.7	57	219	101	4.8	8.5	35.0	16.5	1.5	1.6
05	Capinapolis 8146	4895	55.7	55	210	96	0.5	9.3	42.3	24.5	1.1	2.1
06	La Molina 8146	4981	58.0	56	194	89	4.0	14.3	30.0	20.0	1.4	2.1
07	Tlaltiza	4470	50.4	54	190	78	-	12.3	38.0	20.0	1.1	2.5
08	Pirsabak 8146	5088	57.3	55	206	97	-	12.3	29.8	21.5	1.4	2.8
09	Coimbatore 8156	5621	54.0	58	205	93	1.0	11.8	32.0	14.8	1.3	2.3
10	Across 8146	6678	49.7	54	198	80	2.3	5.5	36.3	20.8	1.3	2.3
11	Across 7845 RE	6630	50.7	60	214	95	2.0	13.5	47.0	24.0	1.0	1.6
12	Across 7745RE	6316	52.0	53	210	84	2.0	17.3	31.0	20.3	1.4	1.9
13	Khumal Yellow	6049	51.0	61	241	126	6.3	17.3	42.0	6.3	1.6	1.8
14	Rampur Composite	6252	56.0	62	231	132	4.3	10.5	33.0	8.5	1.5	1.5
15	Arun-2	6642	55.4	58	245	124	2.5	12.8	35.5	8.3	1.4	1.4
	F-test	*		**	**	**						
	L.S.D. (0.05)	1876		21	22	17						
	C.V. %	21		3	7	11						

Development And Evaluation Of A White Maize Variety - Manakamana-1

Toya Mishra and
Shyam Chand*

ABSTRACT

The objective of this study was to develop a white maize variety for hills during summer and for tarai during winter. The breeding work for white maize variety started from germplasm collection in 1977. Fifteen different materials (including local germplasm) - temperate, sub-tropical and tropical, constituted the variety - Manakamana-1. About 60% of the source was temperate, sub-tropical type and the breeding work was carried out at Rampur during winter and at Pakhribas during summer. Each advanced cycle was made available for testing under different ecological zones of the country. The results from 1979 - 1984 measure the progress made by breeding. Manakamana-1 and Khumal Yellow, a standard check, were at par for many traits. Manakamana-1 was also at par for yield with Pioneer 6181. Advanced cycle from unit selection has not been tested yet. The preliminary evaluation of the units at Pakhribas Agriculture Centre (PAC) and Khumal gave very encouraging results. The selected units will be made available for multi-location testing during summer and winter 1985. So far the results indicated that Manakamana-1 could be successfully grown in hills during summer and in tarai during winter.

INTRODUCTION

There is a pressing need for a good white maize variety in the country. In fact, we do not have as many white germplasm available as yellow ones. Many countries in the world grow only yellow maize. On the other hand, germplasm collected from the different parts of the country clearly indicate the farmers' likings and need of white maize varieties. Out of 50 maize germplasm collected (6), 40% of them were white. Similarly, 66% of the local germplasms collected in 1984 were white. Farmer's liking of white over yellow is mainly because of social value. The grit of white maize looks like rice while cooking. For many farmers, serving their guests with white maize is prestigeous and also farmers claim better taste of white maize (cooked-grit) over yellow. Farmers in Dhankuta, Terahthum, Taplejung, Bhojpur, Sankhuwasabha, Illam, Panchthar, Salyan, Rolpa, Dang, Pyuthan, part of Kaski, eastern tarai and many other parts of the country, are after white maize. Farmers in these areas grow local white maize varieties for their own use. Farmers even in yellow maize

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growing areas demand white varieties. As a result, NMDP has also given emphasis on developing white maize varieties.

Nepal has climates ranging from tropical to temperate. The environment changes from foot hill to the top, from the south side to the north. Same is true when we talk about disease problem. All these environments need different varieties but at present, it is neither economical nor feasible to develop a separate white variety for each micro-environment. Major problem will be of maintaining, producing and supplying the seeds of each variety since the seed of a cross pollinated crop like corn need to be grown in isolation. Unlike in the self-pollinated crop, farmers cannot maintain the pure seeds of a maize variety. Hence, it has been hypothesized that a new variety should cover a broad ecological zone so that it will be economical to multiply the seeds of a new variety and be supplied to the farmers.

Secondly, Nepal has lots of cropping hazards such as over rain, drought, diseases, insects etc. It has been hypothesized that a new maize variety must have reasonably good tolerant to cropping hazards. Taking the above considerations into account, it has been tried to have a broad genetic base of a new variety.

MATERIALS AND METHODS

Collection of white maize germplasm was started in 1977. Maize introductions from various programs of the world as well as from different regions of the country were evaluated at Khumal, Kakani and Rampur (winter) during 1978-1979. More than 50% of the materials were obtained from CIMMYT and rest of the materials were collected from other programs as well as locally. These materials were studied for various agronomic attributes, including maturity, height, yield potential and reaction to different cropping hazards. Out of 55 materials, only 30 were identified as potential materials (Table 23) and a breeding program of a white variety (Medium maturity) was started in 1978-79. Out of 30 entries, most of them were entered only as female entries and after 2 cycles of selection, 15 female entries were taken out (discarded). Finally, the materials (2) constituting the white maize variety, Manakamana-1 were as follows:

Manakamana - 1

Barbote White; Ujala White; Rampur 8075; Neta White; Suwan 8075; Amarillo del Bajio X 10 lines PD (MS) 6 Phil. DMR; Suwan-1, Janaki Makai; Pozarica 7425; Eto Blanco; Pool 19; Pool 23; Maracay 7530; Ilonga 7530; Tuxpeno drought selection.

These diverse germplasm were allowed to recombine for generations. The half-sib method of selection was exercised until 6 cycles of selection. Rampur in the winter and PAC in the summer were our breeding sites. Approximately, 450 half-sib families were selected per cycle. In the process of selection, all female rows and undesirable male plants were detasselled. Yield potential, plant height, maturity, lodging, disease and insect reaction and uniformity were taken into account at appropriate stages of plant development. The half-sib families were inoculated mainly with fusarium cob-rot (Fusarium moniliforme) at PAC. It is a good site for screening the material for cob rot since the disease appears even if we don't inoculate. At appropriate stages, the plant pathologist evaluated the families for cob-rot. As soon as selected families showed 50-60% brown husk, the early maturing cobs with good husk cover were identified painting the cobs with red or blue paint. After harvest, the selected cobs were again screened for grain type. The individually selected ears formed the half-sib families planted as female rows and balanced mixture of most superior ears formed male rows of the next cycle's planting. Superior ears selected from the male rows of the present cycle were bulked and used for multi-location testing. Khumal Yellow and farmers' variety were used as the standard checks. The results are given in tables 1 - 21. After six cycles of selection, the materials were recombined very well and there was reasonably good amount of progress. The variation within a family was not much. Hence, in the winter season 1983-1984, the selection scheme was shifted from half-sib to unit selection. In the summer season 1984, the units were evaluated at Khumal and PAC. The results are given in table 22. There is only one more breeding step left, i.e. selection of the best unit(s) which will be a winner. At the end of 1985, the final step will be completed.

RESULTS AND DISCUSSION

The objective of this study was to develop a white maize variety for hills during summer and for tarai during winter. Manakamana-1 has been evaluated

at many locations during summer and winter seasons since 1979. In the beginning, the material evaluated was the source per se. Later on, the advanced cycles were evaluated. Khumal Yellow and a farmer's variety were the standard checks. In many cases, other released varieties were also serving as our checks. The results of the testing are given in tables 1 - 23. So far as grain yield is concerned, Manakamana-1 yielded poorly in the beginning. The grain yield of Manakamana-1 averaged over 3 years (1979-1981) over many locations and seasons was 3662 kg/ha whereas Khumal Yellow yielded 4089 kg/ha. The mean grain yield of Manakamana-1 and Khumal Yellow averaged over another 3 years (1982-1984) were 3606 kg/ha and 3617 kg/ha, respectively, (tables 1 - 21). It is at par with Poineer 6181 (3835 kg/ha tables 9 and 12). It is because, in the first phase, the germplasm included in Manakamana-1 were allowed to recombine and the selection pressure was low. As selection cycles were advanced, the pressure of selection was increased and reasonable amount of progress from selection was noticed. As the material was advanced to 5th cycle of selection, the gain from half-sib selection was not much and hence, the selection method was changed to unit selection. Units were evaluated during summer 1984 at Khumal (for yield) and PAC (for cob-rot). The results are given in table 22. The mean grain yield of 6 selected units was 6.12 t/ha, whereas the population mean was 3.04 t/ha. The Checks, Khumal Yellow and Manakamana-1 (bulk of 5th cycle) yielded 2.54 t/ha and 2.6 t/ha respectively. The results of selected unit are very encouraging and these six units will be evaluated at many locations during summer and winter 1985.

So far as maturity, plant height, and husk cover are concerned, Mana-1 is medium in maturity, plant height and husk cover, similar to our standard check, Khumal Yellow. The flowering days for Mana-1 and Khumal Yellow averaged over years, locations and seasons (tables 1-21) were 90 and 90.5, respectively, similarly, cobs with bare tip in case of Khumal and Mana-1 were 14% but farmers' variety had only 7% bare tipped ears. Improved maize tend to bear the grain up to the tip of the cobs and cobs are also bigger. This leads to open the tips of the cobs. In fact, this 7% difference is not much. Nevertheless, selection for this trait will be continued. It will take time since this trait is lowly heritable.

In case of diseaes and insects, data have been recorded mostly under natural infestation conditions (tables 18 - 22). Data recorded under natural

infestation conditions do not reflect the true tolerance level of a variety. However, it does give some ideas. Based on the data taken under natural infestation conditions, the tolerance level of Mana-1 to different diseases is similar to Khumal Yellow. The families (units) from advanced cycle of Mana-1 were inoculated with fusarium cob-rot and the results are given in table 22. The population mean for cob-rot was 47% whereas selected unit mean was 33% (30% gain). Cob rot means for check 1, 2 and 3 were 40%, 39% and 44% respectively. Until and unless the labs are equipped at least with minimum facilities needed; screening against diseases and insects can not be done effectively. As far as the question of tolerance of Mana-1 to other cropping hazards, such as drought or over rain, cold or hot is concerned it has been tried to expose the material in all possible environments and get more informations about it. So far, the results are encouraging. It has temperate, sub-tropical and tropical germplasm in it. It could be grown successfully in all the regions. However, a greater portion of it is temperate, sub-tropical type and since the selection was done at PAC during summer and at Rampur during winter, the number of genes that prefer cooler climate (gene frequency) might have been increased. Our results from 1979 - 1984 have given little indication in support of this assumption. Therefore, Mana-1 can be a good variety for tarai during winter and for hills during summer. Minikit results and further evaluation of the material advanced from unit selection will add more informations to our results.

CONCLUSIONS

1. Results from 1979 - 1984 indicated that Mana-1 could be pre-released and farmer's can start growing it as their white variety.

2. This variety can be grown successfully in many regions of the country since it has temperate, sub-tropical and tropical germplasm in it. However, its tolerance to different cropping hazards during summer in tarai is questionable because it has not been screened for.

3. Response of the variety to nitrogen and other cultural practices need to be studied.

4. Irrigation trial with this variety is highly needed because farmers in tarai during winter may grow this variety under irrigated conditions.

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Table 23: Germplasm Collected And Evaluated

01. Amarillo Del Bajio X 10 lines PD (MS) 6 X Phil. DMR
02. Pozarica-7425
03. Eto Blanco
04. Janaki Makai
05. Tuxpino drought selection
06. Ujala Makai
07. Rampur 8075
08. Suwan 8075
09. Cuyuta 7632
10. Cali 7623
11. Gemiza 7523
12. Pool 23
13. Pool 31
14. Ilonga 7530
15. Maracay 7530
16. Pantanagar 7425
17. Suwan-1 (White)
18. D 742 X Himalayan Phil. DMR 4
19. D 774
20. Sarlahi Seto (Recommended Variety)
21. Sarlahi Seto (Local)
22. Baglung White
23. Seti Makai
24. Pool-19
25. Barbote White
26. Dhaulo Thulo Makai
27. Basbari Seto
28. Thulo Seti Makai
29. Maracay 7525
30. Nota White

Table 1:

MEANS AVERAGED OVER 5 LOCATIONS (1979)*

Genotypes	Grain Yield Kg/ha.	Days to 50% Silking	Plant Height (cm.)	Ears with Bare Tips %	Cob Rot %	Rust (1-5 Scale)
1. Khumal Yellow	4036	81	201	7	15	2
2. Rampur Composite	4039	80	225	8	12	2
3. Manakamana-1	2891	82	216	7	12	2
4. Sarlahi Seto	2767	85	231	8	10	2
5. Local Check	2148	76	213	-	5	3

* - For detailed informations, see ref. no. 4: 32-43.

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Table 2:

FARMERS' FIELD TRIAL, PUMDI BHUMDI, 1979**

Sites	Genotypes -	Grain Yield (t/ha)				
		Manakamana-1	DMRS-10	Amrillo Pakistan	Khumal Yellow	Local
1		1.01	2.01	2.59	3.12	2.74
2		0.56	1.60	1.33	2.14	-
3		3.23	2.86	5.94	3.54	3.30
Average :		1.60	2.16	3.29	2.93	3.02

** - For detailed informations, see ref. no. 4: 118

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Table 3:

GRAIN YIELD (KG/HA) OBTAINED FROM FARMERS FIELD TRIALS, 1979 MONSOON SEASONS (HILLS)***

Genotypes	Locations- Ilam	Jhapa	Tanahu	Dhading	Sindhuli	Ramechhap	Mean
1. Khumal Pahenlo	2344	4333	6822	7189	5444	4178	5210
2. Hetauda Composite	2878	4844	4422	4633	3889	6244	4723
3. Manakamana-1	2269	4600	4044	4311	3333	4667	4013
4. Janaki Makai	4829	3733	4600	4811	4667	4689	4604
5. Farmer's Local	2369	4000	2267	3300	2444	5311	3538
LSD (0.05)	1331	-	3151	3034	2929	-	

*** For detailed informations, see ref. no. 4: 200-206.

Table 4: MEANS AVERAGED OVER FIVE LOCATIONS (1980)* (HIGH ALTITUDE TRIAL, N M D P)

Genotypes	Grain Yield Kg/ha	Days to 50% Silking	Plant Height (cm.)	Lodging % Root	Lodging % Stalk	Bare Tip %	Cob Rot %
1. Kakani Pahenlo	446.	106	221	9	4	24	5
2. Manakamana-1	4358	106	192	5	3	28	13
3. Local Check	3164	93	204	6	2	21	12

* - For detailed information, see ref. no. 5: 14-23.

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Table 5: MEANS AVERAGED OVER FOUR LOCATIONS (1980)**(LOW AND MID ALTITUDE TRIAL)

Genotypes	Grain Yield Kg/gha	Days to 50% (Silking)	Plant Height (cm.)	Bare Tip %	Lodging % Root	Lodging % Stalk	Cob Rot %
1. Khumal Yellow	4489	69	183	7	12	4	18
2. Manakamana-1	3736	71	188	10	10	6	14
3. Local Check	2383	69	209	2	20	12	11

**- For detailed informations, see ref. no. 5: 19-23

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Table 6: GRAIN YIELD (KG/HA), (NMDP VARIETAL TRIAL, 1981)+

Genotypes	Locations-	Rampur	Tarahara (W)	Khumaltar	Kabire	Lumle	Pakhribas	Jumla	Mean
1. Khumal Yellow		3840	5400	5486	2578	3555	2636	5176	4096
2. Manakamana-1		2200	5267	5397	3718	5012	4118	5317	4433
3. Hetauda Composite		-	-	-	-	-	3307	-	3307
4. Local Check		2853	3787	3537	3243	3495	3680	2330	3275
CV %		17	11	19	36	17	15	20	
LSD (0.05) Kg/ha -		773	797	1662	1395	905	447	1237	

+ - For detailed informations, see ref. no. 6: 15-44

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Table 7: MEANS AVERAGED OVER SEVEN LOCATIONS (NMDP VARIETAL TRIAL, 1981) x

Genotypes	Days to 50% Silking	Bare Tips %	Plant Height (cm.)	Root Lodging (%)	Rotten Cobs (%)
1. Khumal Yellow	85	14	186	12	14
2. Manakamana-1	91	13	198	1	18
3. Hetauda Composite	-	-	-	-	-
4. Local Check	84	6	219	15	11

x - For detailed informations, see ref. no. 6: 15-44.

Table 8: RESULT OF FFT AT KABHRE FARM, 1 9 8 2 (SUMMER)*

Genotypes	Grain Yield (Kg/ha)	% Yield Increase Over Local	Days to 50% Silking
1. Manakamana-1	4927	66	82
2. Arun-2	4018	36	74
3. Kakani Yellow	3152	7	87
4. Rampur Composite	4157	41	87
5. Farmers' Variety	2959	-	81

* - For detailed information, see ref. no. 7: 131

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Table 9: NMDP VARIETAL TRIAL, 1983** (GRAIN YIELD, KG/HA)

Genotypes / Locations:	Lumle	Pakhribas (North)	Dada-pakhar	Jumla	Pakhribas (South)	Tarahara (Winter)	Surkhet	Nepal-ganj	Mean
1. Manakamana-1	3551	3594	2915	3742	3408	6233	3140	1617	3525
2. Pioneer-6181	4915	3130	3000	4213	3597	6467	2667	1796	3723
3. Khumal Yellow	4296	3316	2498	3206	2937	6167	2693	1327	3305
4. Rampur Composite	4349	3414	3797	2965	3573	6567	2887	1491	3630
5. Arun-2	4165	3343	2018	2871	3644	5433	3040	1603	3265
6. Farmers' Variety	4213	3111	2641	2437	771	6900	1627	1721	2928
L.S.D. (5%) -	NS	NS	1463	600	529	NS	NS	NS	-
CV % -	16	13	31	13	11	18	26	38	-

** - For detailed informations, see ref. no. 8: 15-22.*******

Table 10: NMDP VARIETAL TRIAL, 1983x (MEANS AVERAGED OVER 8 LOCATIONS)

Genotypes	Days to 50% Silking	Bare Tip %	Plant Height (cm.)	Root Lodging %	Cob Rot %
1. Manakamana-1	91	9	195	10	2
2. Pioneer-6181	91	12	172	[illegible]	4
3. Khumal Yellow	89	8	197	1[illegible]	7
4. Rampur Composite	90	6	19[illegible]	1[illegible]	6
5. Arun-2	79	7	18[illegible]	10	13
6. Farmers' Variety	90	2	22[illegible]	20	1

x - For detailed informations, see ref. no. 8: 19-22.

Table 11: [illegible] TRIAL 19[illegible] (SUMMER)*

Genotypes	Yield (kg/ha) Doti	Kabhre	Lunle	Pakhribas	Mean	Days to 50% Silking Average Over 4 Locations
1. Manakamana-1	3344	5856	2522	2356	3519	79
2. Khumal Yellow	3500	6500	3289	2656	3986	80
3. Farmers' Variety	2122	3244	3056	2644	2766	75
"F" Value :					NS	

* - For detailed informations, see ref. no. 8: 23-27.

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Table 12: NMDP VARIETAL TRIAL, 1984 1/

Genotypes	Locations:	Grain Yield (kg/ha) Lunle	PAC(North)	Kabhre	Kakani	PAC(South)	Khumal	Tarahara	Surkhet	Doti	Mean
1. Manakamana-1		3281	2557	4376	2474	2396	4536	2838	5067	3234	3418
2. Pioneer-6181		4146	3324	3638	2121	3616	6361	2887	5921	3507	3947
3. Khumal Yellow*		3218	2228	[illegible]043	2366	2916	4597	2269	5122	3333	3351
4. Rampur Composite		3758	2665	2361	2494	3[illegible]56	4862	2637	4559	3747	3349
5. Arun-2		4380	2641	2585	2388	3518	4485	2709	5217	2960	3431
6. Farmers' Variety		3719	2287	2619	2365	1533	4581	1850	4908	3067	2992
L.S.D. (5%) kg/ha -		NS	NS	NS	NS	576	1178	NS	1100	NS	530
C.V. % -		20	22	30	27	14	17	24	14	41	13

* - In case of PAC, no. 3 entry is Hetauda Composite.
1/- For detailed informations, see ref. no. 9.

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Table 13: NMDP VARIETAL TRIAL, 1984**

Genotypes	Means Averaged Over 9 Locations Plants/ha (1000)	Days to 50% Silking	Plant Height (cm.)	Root Lodging %	Ear with bare Tip %	Diseased Ears %
1. Manakamana-1	54.7	80	203	7	11	4
2. Pioneer-6181	55.8	82	180	4	13	8
3. Khumal Yellow	54.1	80	207	9	10	10
4. Rampur Composite	54.9	80	199	7	13	6
5. Arun-2	53.1	71	195	7	13	11
6. Farmers' Variety	50.0	76	234	14	4	3

* - For detailed informations, see ref. no. 9.

Table 17: EFFECT OF MAIZE VARIETY ON YIELD OF RELAYED LOCAL FINGER MILLET VARIETY AT PURBI BHUMDI DURING SUMMER SEASON, 1984*

Genotypes (Maize)	Grain Yield (t/ha)			Days to Maturity For Maize
	Maize	Finger Millet	Total	
1. Manakamana-1	3.83	2.36	6.19	122
2. Khumal Yellow	3.77	2.48	6.25	126
3. Arun-2	4.23	2.86	7.09	119
4. Local	2.02	2.86	4.88	107

* - Data received from Cropping Systems Program. See Cropping Systems Report for detailed informations.

Table 14: MAIZE VARIETY TRIAL RESULTS, 1984*

Means Ave. Over 5 Farmers' Field

Genotypes	Locations: Pumdi Bhundi (Summer) Yield (t/ha)	Maturity (Days)	Plant Pop. (1000/h)	Khandbari (Summer) Yield (t/ha)	Maturity (Days)	Plant Pop. (1000/h)	Khandbari (Winter) Yield (t/h)	Maturity (Days)	Plant Pop. (1000/h)
1. Manakamana-1	3.74	124	39	2.73	106	28	2.00	101	28
2. Khumal Yellow	3.67	125	33	2.99	106	30	-	-	-
3. Arun-2	3.87	123	41	-	-	-	1.67	95	30
4. Local	2.52	117	32	2.04	106	29	1.51	96	32
L.S.D. (0.05) t/ha -	0.85			0.64			0.40		

* - Data received from Cropping Systems Program. See Cropping Systems Report for detailed informations.

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Table 16: NMDP FARMERS' FIELD VARIETAL TRIAL DURING SUMMER 1984**

Means Averaged Over 2 Sites

Genotypes	Locations: Khumal Yield (t/h)	Khumal Plant Pop. (1000/ha)	Kakani Yield (t/ha)	Kakani Plant Pop. (1000/h)	Kabhre Yield (t/ha)	Kabhre Plant Pop. (1000/ha)	P A C Yield (t/h)	P A C Plant Pop. (1000/ha)	Mean Yield (t/ha)
1. Manakamana-1	5.01	46	2.73	44	3.19	-	2.14	-	3.37
2. Khumal Yellow 1/	5.75	51	2.80	47	2.82	-	2.17	-	3.38
3. Farmer's Local	6.01	50	3.49	49	2.07	-	2.23	-	3.45
L.S.D. (0.05) t/ha -									

** - For detailed informations, see FFT Report of NMDP, 1984

1/- In case of PAC, no. 2 entry is Hetauda Composite.*******

Table 17: NMDP FARMERS' FIELD VARIETAL TRIAL IN CHITWAN DURING WINTER 1984x

Genotypes	Locations: Panchkanya Yield (t/ha)	Panchkanya Plant Pop. (1000/ha)	Pithuwa Yield (t/ha)	Pithuwa Plant Pop. (1000/ha)	Gunja Nagar 6 Yield (t/ha)	Gunja Nagar 6 Plant Pop. 1000/ha)	Gunja Nagar 5 Yield (t/h)	Gunja Nagar 5 Plant Pop. (1000/h)	Mean Yield (t/ha)
1. Rampur Composite	3.27	39	4.62	38	4.11	50	3.07	42	3.76
2. Manakamana-1	4.62	37	4.24	43	3.19	39	2.45	38	3.61
3. Farmer's Local	3.39	37	4.00	41	[illegible]	41	[illegible]	41	[illegible]
L.S.D. (0.05) t/ha :	0.77		NS		NS		NS		

x - For detailed informations, see NMDP Varietal Trial Report, 1984.

Genotypes	Yield (t/ha)	Cob Rot %		Stalk Rot %	Common Rust (0-9)
		Inoculated	Non-inoculated		
1. Arun-2	3.8	2	10	3	4
2. Manakamana-1	4.6	17	17	2	5
3. Khumal Yellow	3.4	8	15	5	5
4. Kakani Yellow	3.0	1	0	7	4
5. Hetauda Composite	2.6	3	0	9	6
6. Rampur Composite	4.1	37	20	8	5
"F" test	**				

1/ - For detailed informations, see ref. no. 6: 192-193.

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Table 19: COB ROT DISEASE (%) AVERAGE OVER 2 YEARS (1980-81)*

Genotypes / Locations:	Kakani	Jumla	Lumle	Pakhribas	Khumaltar	Kabhre
1. Khumal Pahenlo	49	10	13	17	5	11
2. Manakamana-1	38	14	18	23	5	12
3. Kakani Yellow	25	-	10	9	-	-
4. Hetauda Composite	37	13	2	9	5	-
5. Local Check	-	2	-	1	-	-

* - For detailed informations, see ref. no.6: 107-114

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Table 20: RUST DISEASE (0-5 SCALE) AVERAGE OVER TWO (2) YEARS (1980 - 1981)**

Genotypes / Locations:	Kakani	Kabhre	Khumaltar	Lumle	Jumla
1. Khumal Pahenlo	2.3	3.0	1.6	2.5	2.0
2. Manakamana-1	2.5	2.0	2.5	1.0	1.0
3. Kakani Yellow	2.4	2.3	-	1.5	-
4. Hetauda Composite	3.3	3	2.6	2.5	2.0
5. Local Check	-	3.0	-	3.0	-

** - For detailed information, see ref. no. 6: 107-114.

Table 21: BORER INFESTATION UNDER NATURAL CONDITION AT RAMPUR (1980/81)*

Genotypes	Borer / Plant		Tunnel Length/Plant (cm)		% Infestation		Rating (1-9 Basis)	
	1980	1981	1980	1981	1980	1981	1980	1981
1. Khumal Pahenlo	0.34	0.37	5.18	12.95	53.3	23.5	4.1	3.66
2. Janaki Makai	0.70	0.43	7.63	14.13	78.6	31.3	7.0	4.66
3. Sarlahi Seto	0.83	0.67	8.37	18.92	87.0	46.2	6.8	6.00
4. Hetauda Composite	0.93	0.3	7.44	7.75	79.0	17.0	5.3	3.00
5. Manakamana-1	0.26	0.43	5.27	10.15	68.6	39.8	6.8	4.00
6. Chitwan Local	0.91	0.47	5.72	14.46	79.0	36.7	7.3	6.00

1 = Plant showing no injury
9 = Plant showing dead heart.

* - For detailed informations, see ref. no. 6: 95-98.

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Table 22: MANAKAMANA-1 UNIT RESULTS FOR KHUMALTAR DURING SUMMER 1984

	No. of Units	Yield (t/ha)	Plant Population (1000/ha)	Days to 50% Silking	Cob Rot % (Inoculated at PAC)
1. Population means	137	3.04	45.3	71	47
2. Slected Unit means	6	6.12	46.7	67	33
3. Selection Differential		3.08 (101 %)	-	4	14 (30%)
4. Pop. Max.		7.27	-	-	100
5. Pop. Min.		0.6	-	-	12
6. Check-1 Means *		2.54	42.7	68	40
7. Check-2 Means *		2.6	41.1	72	39
8. Check-3 Means *		-	-	-	44

* - At Khumal, Check-1 = Khumal Yellow, Check-2 = Mana.-1 (Bulk)
At PAC, Check-1 = Hetauda Composite, Check-2 = Mana.-1 (Bulk), and
Check-3 = Amarillo Del Bajio.

Report On Observation Nursery - 1984

B.K. Baniya and
R.B. Shah*

The objective of this nursery was to study the agronomical characteristics of the local maize germplasms; and utilize them in breeding program, if they possessed desirable qualities.

National Maize Development Program, Rampur had collected 38 local maize varieties from 15 districts. These materials were tested at Khumaltar condition in 1984 summer. The plot size was one row of 5 meter long and only one replication was used row to row and plant to plant spacing were 75 cm and 25 cm respectively. Level of fertilization was 120 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha. $ZnSO_4$ and BHC also were used @ 20 kg/ha. Grain yield was adjusted to 15% moisture. Foliar diseases as well as plant and ear vigours were recorded on 0 to 5 scale. Zero means no disease or very poor vigour and 5 means heavy infection or high vigour. Though the grain color was recorded, the observation may not be accurate due to xenic effect.

The detail observations for different traits of these locally grown maize varieties are given in Table 6. The yield performance is summarized in Table 1. Though, these varieties were grown at high fertility level and optimum management condition, their yield potential was quite low. Fifty percent varieties yielded around one ton per hectare. Majority of the varieties were very tall and about 50% of them were 261 to 320 cm tall (Table 2). Temelse Makai (215 cm), Sathiya Seto Makai (210 cm), Pahenlo Makai (225 cm) and Pahenlo Makai (218 cm) had short plant stature (Table 6). About 32% varieties took less than 61 days for 50% silking and they can be considered as early ones (Table 3). Root lodging was not the problem, although stalk lodging was a major problem. About 26% varieties showed open ear tip and about 44% had ear rot problem, but the extents of open ear tip and ear rot were not high.

Most of the varieties had low plant and ear vigour. About 66% varieties were white to semi-white in grain color (Table 4). So, majority of these fifteen

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districts farmers preferred white to yellow maize. About 95% of these varieties were either flint or semi-flint grain type (Table 5). So our breeding program should focus to develop white and flint grain type populations.

Some of the locally grown maize varieties possessed desirable characteristics; and they can be incorporated in our early and full season populations.

REFERENCES

Anonymous, 1972. The Local Maize Collection Report On Maize Coordinated Program, 1971-1974.

Mishra, Toya Nath and Shyam Chand, 1985. Development and Evaluation of a White Variety: Manakamana-1. Paper Presented at 12th Summer Crop Workshop at Rampur from January 28 to February 1, 1985.

Observation Nursery - 1984

Table 6: Location: Khumaltar

Planting date: May 22, 1984
Harvesting date: Sept 13, 1984

S.No.	Ent. No.	Variety	District	Yield kg/ha	Days to 50% silking	Plant height cm	Lodging % Root	Lodging % Stalk	Rust (0-5)	H. turcicum (0-5)	Husk cover % (0-5)	Ear-rot %	Ear Vigour (0-5)	Plant Vigour (0-5)	Grain type	Remarks
1.	2	Dhartani Makai	Myagdi	1140	66	227	5	32	1.5	1.5	-	-	2.0	2.0	S.F.	
2.	3	Thulo Pahenlo	"	1120	63	300	-	29	1.0	1.0	5	-	2.5	2.5	F	
3.	5	Pahenlo Makai	"	712	56	239	-	25	1.5	1.5	-	11	1.5	1.5	S.F.	
4.	6	"	Dolkha	1112	63	312	10	-	1.0	1.0	-	-	2.5	1.5	S.F	
5.	7	Sathiya Makai	"	4777	62	245	-	19	1.5	1.0	-	-	1.0	1.0	S.F.	
6.	8	Agute Thulo Pahenlo	"	1253	62	311	6	-	1.0	1.5	-	-	1.5	2.0	S.F.	
7.	9	Chepti Makai	"	981	59	204	-	20	2.0	1.5	-	-	1.5	1.0	S.F.	
8.	10	Sathiya Seto Makai	"	581	59	202	14	-	2.0	2.0	-	6	1.0	1.0	"	
9.	11	Pahenlo Darlinge "	"	1634	64	300	-	16	3.0	1.5	-	-	2.5	2.5	"	
10.	12	Temase Makai	Dadeldhura	437	57	215	-	35	2.5	1.5	-	25		1.0	F	
11.	13	Seto Makai	"	691	57	232	-	56	3.5	2.0	-	31	1.5	1.0	S.F.	
12.	18	Sanu Pahenlo "	Jhapa	1085	66	251	-	-	3.5	2.0	5	-	3.0	2.5	S.F.	
13.	19	Sthani Pahenlo	"	1300	60	203	-	15	2.0	1.5	-	-	2.0	2.0	S.F.	
14.	20	Sathiya Makai	"	1106	62	202	-	11	2.0	1.0	-	-	2.5	1.5	S.F.	
15.	21	Pahenlo "	"	1031	66	266	-	67	1.5	1.5	-	27	1.0	1.5	F	
16.	24	Seti Makai	Khotang	1007	63	300	-	12	1.0	1.0	-	6	1.5	1.5	S.D.	
17.	25	Chepte Makai	"	992	50	223	-	-	1.0	1.0	-	-	1.5	1.0	"	
18.	29	Seto Makai	Parbat	941	58	205	-	21	1.0	1.0	-	-	2.0	1.0	F	Large grain
19.	30	Baglunge Seto Makai	"	1032	54	257	-	11	2.0	1.5	-	-	2.0	1.5	S.F.	
20.	31	Sathiya "	"	217	55	210	-	16	1.5	1.5	-	-	1.5	1.0	S.F.	

21.	34	Chiniya Pahenlo Makai	Terhathum	881	64	311	-	20	1.0	1.0	-	-	2.5	1.5	F	
22.	35	Seto Makai	Dhankuta	1174	65	342	-	16	1.0	1.0	-	-	2.5	1.0	S.F.	
23.	37	Seto "	Baglung	1203	61	271	-	5	1.5	1.5	5	-	2.0	2.5	"	
24.	38	Antare "	"	1541	57	274	6	24	2.0	2.0	-	-	1.0	1.0	"	
25.	40	Sthaniya Pahelo	Argha-Khanchi	1355	60	333	5	16	2.5	1.5	5	6	3.0	1.5	"	Dark brown large grain
26.	45	Sakale Seto Makai	Rolpa	904	Late	375	-	17	2.0	1.0	13	7	3.0	2.0	"	Large grain
27.	46	Chipte "	"	803	"	345	-	5	2.0	1.5	5	-	2.0	1.5	"	"
28.	47	Chepte "	"	1741	69	335	-	10	1.5	1.5	12	7	3.5	2.5	"	"
29.	48	Chunwangi "	"	1336	60	340	-	14	1.5	1.5	0	6	3.0	2.5	F	
30.	52	Pahenlo Makai	Lamjung	521	55	225	-	33	1.5	2.0	-	6	1.0	1.0	F	
31.	57	Pahenlo "	"	330	53	210	-	60	2.0	2.5	-	10	0.5	0.5	F	Small grain
32.	58	Bardano "	Tanahu	700	67	302	-	45	2.0	1.0	-	-	1.5	1.5	S.F.	
33.	59	Seto Makai	Salyan	1160	65	295	-	17	1.5	1.0	-	7	2.5	2.0	"	
34.	60	"	"	1160	62	270	-	20	2.0	2.0	5	6	2.5	2.5	"	
35.	61	Paise Makai (Thulo seto)	"	1130	61	283	-	-	2.0	1.0	-	13	2.0	2.0	"	
36.	65	Sthaniya Thulo Makai	Rolpa	615	Late	330	-	-	1.5	2.0	6	13	2.5	2.0	"	
37.	66	Badhi Makai	"	703	61	262	5	6	2.0	4.0	-	6	1.0	1.0	"	
38.	67	Sete Lasune Makai	Dhankuta	1004	70	371	-	5	1.5	1.0	-	-	2.0	2.0	F	

Note: S = Semi, W = White, Y = Yellow, F = Flint, D = Dent, 0 = No Disease, 5 = Heavy Disease
0 = Poor Vigour 5 = Best Vigour.

Conservation Tillage Research On Summer Maize In Rampur, Chitwan, Nepal

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ABSTRACT

Maize (Zea mays Linn) was planted under conventional noburning and burning, and conservation minimum and notillage systems at C, 50 and 100 kg N/ha during the 1984 summer maize growing season at two sites in Rampur, Chitwan, Nepal to see their effect on yield and moisture use. Due to above normal rainfall during the maize growing deason the effect of conservation tillage on moisture saving and hence the yield of maize was not significant. However, increase in application of nitrogen significantly contributed to higher maize yields under all tillage systems. No significant interactions of tillage systems and fertility were observed. Burning stubbles significantly decreased the severe damage done to maize crops by wire worm at one of the sites.

Maize is cultivated in Nepal as main summer-rainy season crop on unirrigated hill slopes and on uplands in the tarai. An early sown crop of maize (spring maize) is also cultivated on rice Khet lands with or without a winter crop of wheat. It is usually planted by conventional tillage after harvest of the previous crop which may be either cereals like wheat, barley and millet or oilseed crop like mustard.

Maize crop suffers from excessive drought during the vegetative stage (main season summer crop) and or during silking stage (usually spring crop) before the onset of the monsoon in June-July (Sharma, 1983). After the onset of the monsoon, excessive erosion of sparsely covered (clean cultivated and not enough canopy development) maize fields is a serious problem especially on Pakho (rainfed) lands on the hills. Besides others, both drought and erosion are the two most important limitations to increase maize productivity. To overcome such problems, adoption of cropping systems that conserve soil and water are essential.

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Decades of research on alternative crop and soil management systems in other countries have recommended conservative tillage in place of conventional tillages (Journal of Soil and Water Conservation. Conservation tillage: A special issue, May - June 1983). Conventional tillage uses plows or other soil turning devices which leaves minimum amount of previous crop residues on the surface. This practice exposes the soil particles to vagories of raindrop bombardment and promotes more erosion and runoff. It also induces rapid seal formation which lowers the amount and rate of infiltration of water into the soil, and hence the availability of soil water in non-rainy days. The doctrine of conservation tillage recommends to leave maximum crop residues on the surface and to minimize soil disturbance. Mulch helps to dissipate kinetic energy of falling raindrops thereby reducing erosion and seal formation. This helps minimize infiltration and minimize evaporation and hence to increase soil water availability and decrease sufferage from drought. Conservation tillage methods range from minimum tillage to no tillage at all.

The advantage of reduced tillage systems include increased energy efficiency, savings in time and labor at peak periods, increased water infiltration and reduced surface evaporation, earlier planting and reduced erosion (Moncrief and Schulte, 1979). The latter is probably the biggest single advantage in Nepalese hills. Conservation of soil moisture is another major advantage of conservation tillage systems (Blevins et al., 1983). Less evaporation under no-till systems early in the growing season may carry the crop through the drought periods eminent before the rainy season.

Early conservation efforts in other countries promoted complete elimination of plowing (Casper, 1983). However, these efforts generally proved unsuccessful in maintaining crop yield. Lal (1979) reviews that fertilizer use efficiency with no-tillage is a controversial issue, and the response is extremely soil and site specific. There are two schools of thought: one believes that fertilizer efficiency is increased without tillage while the other holds the opposite viewpoint. Triplett et. al. (1969) found that maize grain yields were higher for no tillage at all N levels while Bandel et. al.(1975) observed N deficiency symptoms more severe on no-tillage than on cultivated plots. Low fertilizer use efficiency with no-tillage system has been attributed to high weed competition, unfavourable soil temperature, and low microbial response due to

microbial competition. Low nutrient availability in no-tillage soil has also been linked with low nutrient concentration in plant tissue and to low crop yield.

Conventional tillage practices followed in Chitwan under rice-wheat-maize or wheat-maize cropping systems include criss-cross plowing with a soil turning plow. Due to increased demand of wheat stubbles for fodder, roofing ,aterial and other purposes, some farmers harvest wheat by cutting straw close to the ground while others who grow wheat in larger areas and face threshing problems harvest by leaving considerable amount of residue on the surface. The residue is burnt by fire later to clear the land for maize or other crops. Aside from the fact that burning facilitates seedbed preparation, we suspect that many farmers believe they obtain a beneficial response from burning wheat stubble. Generally, burning straw is reported to cause decreases in soil organic matter and soil aggregation and on runoff characteristics of soil (Biederback et. al., 1980).

While erosion of topsoil is taking its toll, farmers in Nepal face uncertainty of rain to harvest satisfactory yields as majority of the maize crop in the country is rainfed. A research on alternative tillage system is a must to conserve valuable soil and water, the commodities in danger of extinction. Besides conserving the natural resources, the effort should also be to increase productivity from that of the conventional method and increase the net benefit so that the new package of technology will be adaptable by the farmers.

The experiment reported here was aimed to find out the responses of four different tillage practices under three levels of N on yield and moisture utilization by the maize crop.

MATERIALS AND METHODS

The experiment was conducted during May to August 1984 maize growing season at Agronomy Farms of the National Maize Develeopment Program (NMDP), Rampur Agriculture Station and the Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan, Nepal (altitude 256 m, latitude 27 deg. 37 min. N, and longitude 84 deg. 25 min. E). The soil at both the experiment sites is sandy loam of about a meter rooting depth and reported to be under an udic moisture regime (LRMP, 1983).

Table 1: Informations About The Experimental Sites

	NMDP Agronomy Farm	IAAS Agronomy Farm
Cropping history	Rice-Wheat	Wheat-Fallow
Amount of stubbles (kg/ha)	3.60	2.20
Height of stubbles (cm)	43	40
Total nitrogen %	0.12	0.22
Organic matter %	2.70	4.40
pH	6.30	5.20

The experiment was laid out in a factorial design with four tillage systems and three nitrogen levels. The treatments were replicated three times. The tillage treatments included:

1. Wheat straw was removed by cutting close to the ground (about 10 cm). Plowing was done by bullock with a mouldboard plow to incorporate the stubbles (CONV NO-BURN).

2. Wheat straw was burnt and the plot was plowed as above (CONV BURN).

3. A furrow was opened with a hoe on the row area only leaving the inter-row area undisturbed (CONS MINIMUM).

4. A planter was used to seed directly on the soil without any tillage (CONS NO-TILL).

Nitrogen at the rate of 0, 50 and 100 kg/ha was applied basal as ammonium sulphate. P was applied on all plots at the rate of 48 kg P_2O_5/ha as triple super phosphate. Fertilizers were side placed along the seed rows in the first three tillage treatments while they were broadcasted uniformly on the no-till plots. Two seeds of maize variety Rampur Composite were sown 25 cm apart on rows 75 cm apart on 6 m by 4.5 m plots. Gy sum blocks were installed at 15 cm and 45 cm below the surface on each plot, and moisture meter readings were taken every day.

A post emergence spray of Atrazine (50% WP) @ 1.5 kg a.i./ha in 600 l. of water was done to control weeds on conservation tillage plots, hoeing and weeding

was done on conventional plots. Furadan was applied in the whorl @1-2 granules/ plant after three weeks of planting.

After three weeks of planting, growth was observed by recording the height of the plants and number of fully emerged leaves every four days. Ears were harvested from a net area of 9 square meters on August 9 and the field moisture content (35%), grain weight per plot was adjusted to 15% moisture content.

RESULTS AND DISCUSSIONS

Plant Height:

The rate of growth in height increased with the application of nitrogen (Figure 1). Though the response of 50 kg N/ha was significant over zero N, the response of 100 kg N/ha was small from that of 50 kg N / ha. There was no difference in rate of growth at the different tillage systems at NMDP.

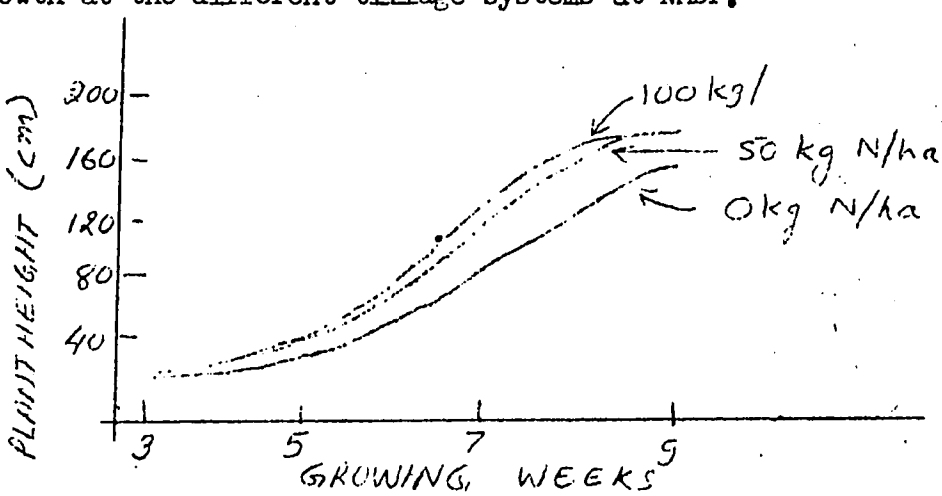

Figure 1: Mean plant heights vs growing weeks at three levels of N at NMDP site.

Maize plants at the IAAS site suffered severely from wireworm (Agrotis) spp.) damage after three weeks of sowing. Uniform burning and yellowing of lower leaves were observed which was due to damage on both plumule and radicle. This caused poor shoot elongation and root growth making the plants under severe fertility stress. A visual abnormality coding (0 = least damaged to 7 = most damaged) was done after 5 weeks of planting which showed that the effect was significantly higher on plots with stubbles and low nitrogen levels (Table 2).

Table 2: Visual Assessment of Wireworm Damage on Maize at the IAAS Site (0 = Normal Healthy .... 7 = Most Damaged)

N levels (kg/ha)	Tillage: Conventional No Burn	Conventional Burn	Conservation Minimum	Conservation No-Till	Mean
0	7	4	7	7	6
50	5	0	3	4	3
100	3	2	5	3	3
Mean	5	2	5	5	

Wireworm damage was not noticed at the NMDP plots even though the amount of wheat stubbles was higher. Figure 2 shows the comparison of height records at the two sites at 100 kg N/ha level. The decrease in height brought about by wireworm damage at IAAS is probably due to the increased population of the wireworm at IAAS. The cropping system at NMDP over the years has included rice,

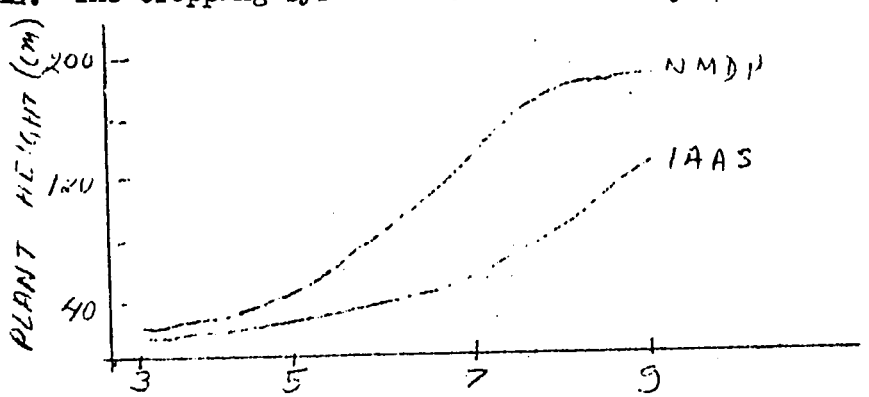

Figure 2: Comparison of Plant Growth at 100 kg N Level Between the NMDP and the IAAS sites.

and hence, the annual puddling might not have favored the colonization of the worms at NMDP. As a result of the wireworm damage, the yield and other informations obtaining at the IAAS site are below normal and hence are excluded from further reporting.

Moisture Use:

Moisture conservation by conservation tillage was not significant in this experiment season. Figure 3 illustrates that the moisture meter readings showed good response to continued evapotranspiration expenses and rainfall incomes of soil water during early growth periods. Higher rainfall during the tasselling and grain formation periods caused water logging which is evident from the increasing heights of the rainfall amount bars and continued near saturation meter readings. A comparison of the cumulative amount of weekly rainfall of this experiment season with that of ten year (1974-1984) record at the NMDP showed that it rained above average during the maize season in summer of 1984 (Figure 4). The effect of water logging resulted in overall decrease in ear and grain formation.

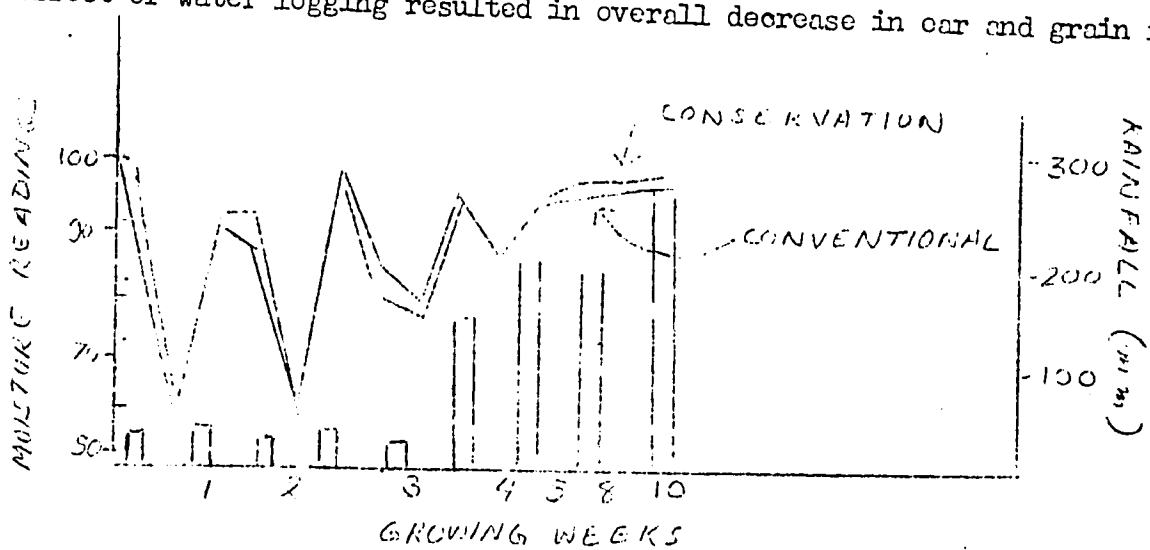

Figure 3: Moisture Meter Readings and Rainfall Amounts at 15 cm in NMDP Site.

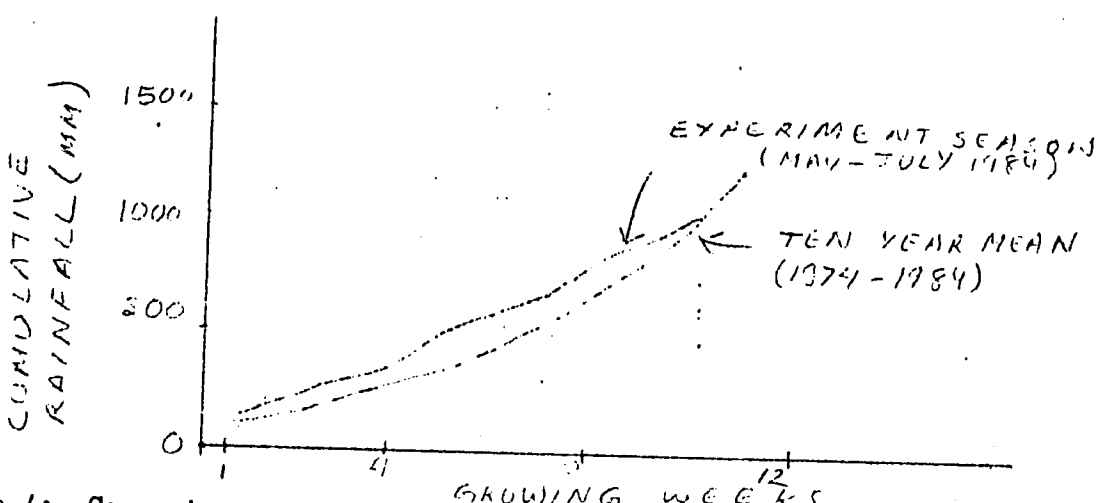

Figure 4: Comparison of Weekly Rainfall of Experiment Season With That of Ten Year Average at NMDP (1974 - 1984).

Grain Yield:

The mean grain yields increased significantly with the application of nitrogen (Table 3). There was no significant effect of different tillage practices at all nitrogen levels.

Table 3: Mean Grain Yields (Adjusted to 15% Moisture) and % Barren Plants at NMDP

	Grain Yield (kg/ha			% Barren Plants		
N Levels (kg/ha)	0	50	100	0	60	100
Tillage						
Conventional						
No-burn	1467	2193	2410	19	11	12
Burn	1463	1457	2730	20	9	10
Conservation						
Minimum	1350	1967	2810	17	13	11
No-Till	1243	1877	2648	31	13	10

Note: F-tests were significant (P .001) for N effects only.

LSD (P .05)	Grain Yield (kg/ha)	% Barren Plants
Nitrogen levels	318 kg/ha	6%
Tillage	367 kg/ha	7%

Though not ssatistically significant, some interesting interactions were noticed on the effect of different tillage practices on yield at different fertility levels. The grain yields decreased with reduction in tillage when nitrogen was not applied. The yields were higher in conventional no-burn at 0 and 50 kg N levels whereas highest yield of 2810 kg/ha was recorded at 100 kg N/ha under minimum tillage (Figure 5).

Table 3 also shows that more plants bore ears with the increase in application of nitrogen though application of 100 kg N/ha did not have any significant effect over application of 50 kg N/ha. Tillage did not have any effect on ear bearing though no-till and zero nitrogen gave the maximum percentage of barren plants.

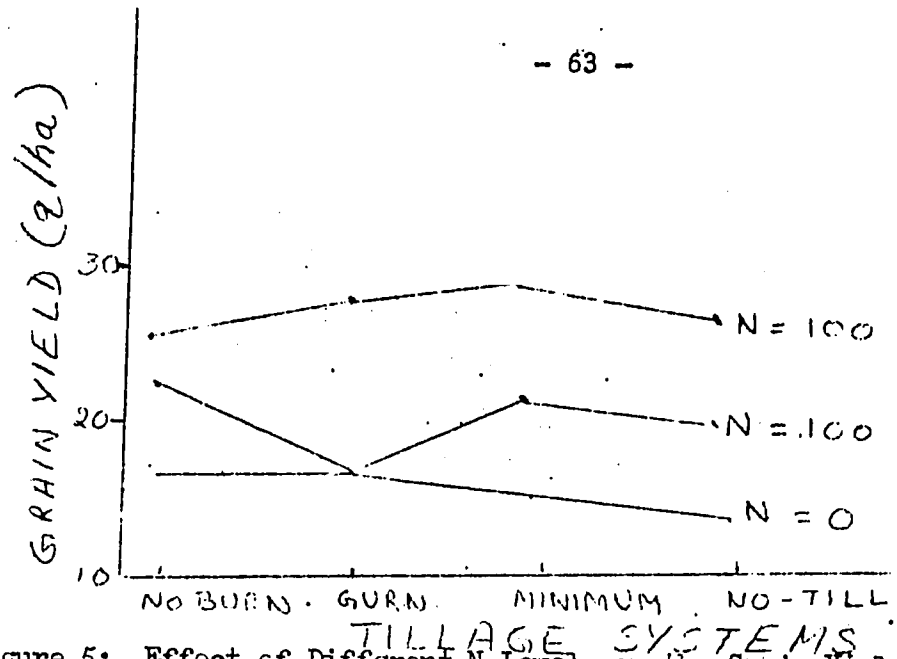

Figure 5: Effect of Different N Levels on the Grain Yield Under Four Tillage Systems at NMDP.

Effect of Burning:

Burning stubbles did not show any response over no-burning at NMDP site. It was interesting to note but difficult to explain the reasons that application of 50 kg of nitrogen did not show any response in yield over no nitrogen on burnt plots. Though the yields were well below normal the relative effect of burning stubbles was highly significant at IAAS site (Figure 6). This again suggests evidences of wireworm effect minimized by burning stubbles.

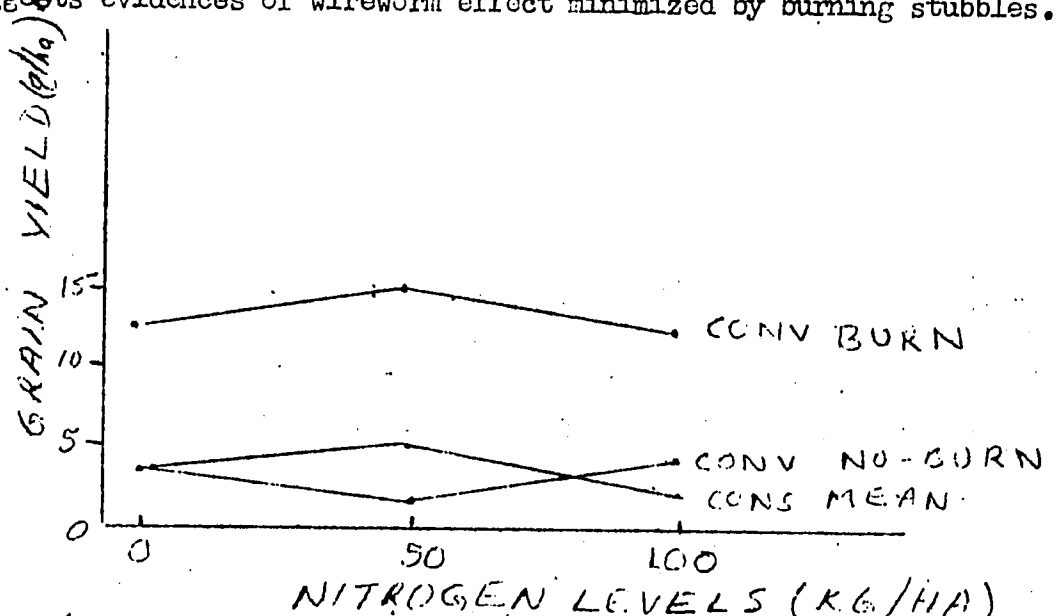

Figure 6: Effect of Burning On Grain Yield at IAAS Site.

ACKNOWLEDGEMENTS

This research was funded by the IAAS/MUCIA/USAID Project. It also marks the beginning of collaborative research between the IAAS and the NMDP in recent years. We are thankful to the sincere research and lab assistance work provided by Keshab Pokhrel, Gam B. Gurung, Satya N. Chaudhary and Durga P. Pokhrel, all B.Sc. Ag. students at IAAS, K.R. Subedi, Junior Technical Assistant, Rampur Ag. Station and Anajan Adhikari, Lab Boy at IAAS.

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Variety Cum Fertilizer Trial on Maize

S.P. Srivastava and
D.D. Neupane*

ABSTRACT

An experiment conducted during the monsoon, 1984 in farmer's field at Shivanagar, Chitwan on early varieties of maize (Arun-1, Arun-2 and Arun-4) at different rates of nitrogen (0, 50, 100 and 150 kg/ha) revealed that Arun-1 and Arun-2 did not respond significantly to increasing levels of nitrogen up to 100 kg/ha. They only responded significantly at 150 kg/ha and Arun-4 responded significantly even up to 100 kg/ha.

Lower rates of nitrogen seem to be more economical than higher rates.

INTRODUCTION

One of the factors affecting the requirement of nitrogen of a particular crop is its genetic constituents. It has been reported that increasing levels of nitrogen from 0 to 160 kg/ha have increasing effects on yield of maize (Khan, 1967). Application of nitrogen at the rate of 240 kg/ha has been found economical (Mandloi et al; 1972).

The yield potential of early varieties of maize such as Arun-1, Arun-2 and Arun-4 in relation to different rates of nitrogen has not been established yet. Therefore it became necessary to conduct an experiment on these varieties under different levels of nitrogen to study their maximum genetic potentiality.

In this study, Arun-1, Arun-2 and Arun-4 were tested at 0, 50 and 150 kg N/ha.

MATERIALS AND METHODS

An experiment consisting of three early varieties of maize (Arun-1, Arun-2 and Arun-4) was conducted under four levels of nitrogen (0, 50, 100 and 150 kg/ha) in farmer's field at Shivanagar in Chitwan. A uniform dose of 40 kg P_2O_5 and K_2O was applied in all the treatments including 0 N treatment. The fertilizer used were Urea, Complexal, Triple Super Phosphate and Murate of Potash.

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Full dose of P_2O_5 and K_2O and ½ of the nitrogen were applied as basal and the remaining ½ of the nitrogen was top-dressed 35 days after planting. The soil was treated with 5 % BHC dust at the rate of 25 kg/ha. Planting was done on May 1, 1984 at the rate of 2 seeds/hill and later thinned to 1 plant/hill. The standard spacing of 75 cm X 25 cm were adopted and the individual plot size was 6 m X 4.5 m. The design was split-plot replicated 4 times with varieties as main plot and nitrogen levels as sub-plot treatments.

Before planting, a composite soil sample was collected and analyzed for pH, organic matter and total nitrogen and the values obtained were 5.30, 2.79 % and 0.13 % respectively.

RESULTS AND DISCUSSIONS

Mean grain yield is presented in Table-1 and agronomic characters in Table-2. Analysis of variance on the grain yield shows that the varietal difference at the same level of nitrogen was non-significant and the variety and nitrogen interaction was also non-significant.

Arun-1 produced the maximum mean grain yield at 150 kg N/ha (2.85 t/ha) which is significantly different from mean grain yield (2.15 t/ha) at 0 kg N/ha. This variety did not respond significantly to increasing levels of nitrogen upto 100 kg/ha.

At 150 kg N/ha, Arun-1 produced the maximum mean grain yield (3.04 t/ha) which is significantly different from grain yields at 0 (1.97 t/ha) and 50 kg N/ha (2.35 t/ha). This variety also did not respond significantly to increasing levels of nitrogen up to 100 kg/ha.

At 100 kg N/ha, Arun-4 produced the highest mean grain yield (3.17 t/ha) which was at par with grain yield at 150 kg N/ha (2.73 t/ha). Although this variety responded significantly to increasing levels of nitrogen up to 100 kg/ha, the response might be partly due to more plant population. At 0 and 50 kg N/ha, all the varieties were at par in grain yield. Results of economic analysis are presented in Table-3.

Economic analysis indicated that lower rates of nitrogen seemed to be more economical than higher rates. The maximum rate of marginal return (73 %) was

was at 50 kg N/ha followed by 100 kg N/ha (60 %). One hundred fifty kilogram N/ha treatment was dominated by both of the above levels, however, this experiment needs to be repeated to confirm the results.

ACKNOWLEDGEMENTS

I am grateful to Mr. V.P. Sharma, Maize Coordinator for providing guidance to compile the results. I also extend sincere thanks to Mr. H.K. Upadhyaya for his kind help in data analyzing.

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Table 1: Effect of Nitrogen Levels on the Grain Yield (Mt/ha) of Three Maize Varieties

Sowing Date: 1/5/1984

Variety	Mean of 4 Replications N. Levels (kg / ha) 0	50	100	150	Mean
Arun-1	2.15	2.41	2.66	2.85	2.517
Arun-2	1.97	2.35	2.57	3.04	2.482
Arun-4	1.88	2.52	3.17	2.73	2.575
Mean	2.00	2.43	2.80	2.87	-

Variety	NS
Nitrogen	*
V X N	NS

CV (MP) = 22.4%

CV (SP) = 17.3%

LSD (0.05) (between N means for the same variety) = 0.63 MT/ha

LSD (0.05) (between N means for different varieties) = 0.75 MT/ha.

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Table 2: Effect of Nitrogen Levels on the Plant Stand, Days to 50% Silking and Plant Height at Maturity of Three Maize Varieties

Treatments Variety	N-Level (kg/h)	Plant Stand/ha	Days to 50% Silking	Plant Height (cm)
Arun-1	0	39,000	50	160
	50	39,000	53	161
	100	36,000	49	166
	150	36,000	51	167
Mean		37,500	51	164
Arun-2	0	35,000	49	163
	50	36,000	48	165
	100	41,000	50	161
	150	39,000	52	161
Mean		37,750	50	163
Arun-4	0	35,000	49	161
	50	38,000	50	158
	100	46,000	51	157
	150	38,000	50	161
Mean		39,250	50	159

Table 3: Economic Analysis on the Grain Yield of Maize Varieties Tested

Field Price :

Maize Grain : Rs.1.50/kg

Urea (N) : Rs.7.00/kg

Application

Cost of Urea/ha: 2 labourers (Rs.10.00/labour)

N-Levels (kg/ha)	Ave.Grain Yield (kg/ha)	Gross Income (Rs/ha)	Total Variable Cost	Net Benefit (Rs/ha)	Marginal Rate of Return %
0	2000	3000	0	3000	
50	2427	3640	370	3270	73
100	2800	4200	720	3480	60
150	2873	4310	1070	3240	(Dominated)

Response of Maize Varieties to Different Levels of Nitrogen Under Upland Rainfed Condition

B.P. Tripathi and
L.R. Pathak*

ABSTRACT

Three varieties of maize Manakamana-1, Manakamana-2 and Khumal Yellow were tested in Khumaltar Farm under rainfed condition at 0, 50, 100 and 150 kg nitrogen per hectare with a bsic dose 40 kg P_2O_5 and 30 kg K_2O/ha. The grain yield of all the varieties increased significantly with the increasing dose of nitrogen. However, the varieties did not differ significantly to each other but Khumal Yellow out-yielded (3882 kg/ha), Manakamana-2 (3794 kg/ha) and Manakamana-1 (2126 kg/ha). The variety Manakamana-2 gave the highest yield (5054 kg/ha) at 150 kg N/ha as compared to other varieties at the same level. The regression analysis revealed that Manakamana-2 was more responsive to nitrogen which gave 30.9 kg grain yield kg N whereas Manakamana-1 gave 28.2 kg and Khumal 26.8 kg. The result suggests further investigation at higher level of nitrogen.

INTRODUCTION

Response of maize varieties under rainfed condition to different levels of nitrogen has been studied in great detail by different workers. Sen and Kavitkar (1956) reported highly significant response to nitrogen but not phosphate. Datta et al (1959) obtained significant increase of 7.29 and 10.91 Q/ha with 45 and 90 kg nitrogen respectively. Modlani and Hukkeri (1965) obtained 16 percent increase in yield by increasing the dose of nitrogen from 50 to 100 kg per ha under rainfed condition. Bains and Dutta (1959) obtained 50 percent increase by rising the dose from 45 to 90 kg nitrogen per hectare. Puntanker et al (1965) tested increasing doses from zero to 135 kg nitrogen and observed a linear response. In view of these considerations, to determine the suitable level of nitrogen under rainfed condition, this study was carried out at Khumaltar.

MATERIALS AND METHODS

Manakamana-1, Manakamana-2 and Khumal Yellow were chosen for study as the main plot. The levels of nitrogen were applied at the rate of 0, 50, 100 and 150 kg/ha with a common basal application of 40 kg P_2O_5 and 30 kg K_2O per hectare

* Assistant Soil Scientists, Division of Soil Science and Agricultural Chemistry Division, Khumaltar, Nepal.

forming a sub-plot treatments. Urea, Triple Super Phosphate and Muriate of Potash were used to supply N, P and K respectively. The experiment was laid out in a split plot design with three replications. The gross plot size was 4.5 m by 3 m and the net harvested area was 6.75 sq.m. The plants were spaced row to row 75 cm and plant to plant 25 cm. Four rows per plot (13.5 sq.m.) were planted with two kernels per hill and plants were thinned to one plant per hill after one month of sowing. The maize seeds were sown on 4th May, 1984 in all the plots in the silt loam soils of Khumaltar Farm during the summer season of 1984.

At the time of planting the entire quantity of P and K and half amount of N was applied to all the plots. The remaining half dose of nitrogen was top-dressed on 11th June, 1984 about 37 days after the sowing of seed in all the treatments except no nitrogen plots. The attack of Helminthosporium disease was observed during the second week of July and yellowing of older leaves were seen due to the excess moisture in the root zone but later on, plants recovered. Some of the plants showed borer attack after one month of sowing and Furadan granules were applied. The tasseling and silking days of all the varieties were noted. Their maturity days were not much different whereas the treatments with no nitrogen and minimum nitrogen (50 kg/ha) were late by one week in tasseling, silking and maturity. Two rows in each plot was harvested on second September, 1984. The moisture contents of the grain were analyzed. The grain yield was adjusted at 14 percent moisture. The results of the grain yield was analyzed statistically.

RESULTS AND DISCUSSIONS

The data on grain yield and agronomical characteristics are given in Table-1 and Table-2 respectively. The mean grain yield data (Table 1) indicated that the grain yield of all the varieties significantly increased with the increasing levels of nitrogen whereas the varieties did not differ at any doses of nitrogen. The nitrogen and variety interactions were not significant. The variety mean grain yield indicated that among the three varieties tested Khumal Yellow out-yielded (3882 kg/ha) all the varieties.

The response of the crop to all levels of nitrogen (0, 50, 100, 150 kg/ha) was found highly significant.

The treatment 4 (150 kg N/ha) was highly significant to treatment-2 (50 kg N/ha)

and control (0 kg N/ha). The 100 kg level (3468 kg/ha) was highly significant to the 50 kg N level (1837 kg/ha). The cost benefit ratio obtained due to application of 100 kg N/ha was the highest (1:8.82) followed by 150 kg N/ha.

The regression analysis of the mean grain yield data indicated the linear relationship (Figure 1) between the N application and the grain yield.

This indicated the varieties were highly responsive to the nitrogen application. The variety Manakamana-2 was more responsive to nitrogen which gave 30 kg grain yield/kg N followed by Manakamana-1 (28.5 kg grain yield kg N) and Khumal Yellow (26.784 kg). This showed that further investigation of application of higher doses of N to exploit the potential of these varieties.

ACKNOWLEDGEMENTS

The authors are very much obliged to Mr. S.P. Pandey and Mr. N.K. Rajbhandari, Assistant Soil Scientists for their cooperation for analyzing the data and preparing the reports. Sincere thanks to Mr. D. Joshy, Soil Scientist, for his valuable suggestions and guidance in conducting the trial. The authors express their sincere gratitude to Mr. Ranjit Shah, Chief, Division of Soil Science and Agricultural Chemistry, Khumaltar, Lalitpur, for providing all the facilities in conducting the trial.

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Table 1: Grain Yield (kg/ha)

Variety	Nitrogen Levels (kg/ha) 0	50	100	150	Variety Total	Variety Mean
1. Manakamana-1	261	1136	2638	4468	8503	2126
2. Manakamana-2	461	2095	3773	5054	11383	2846
3. Khumal Yellow	740	2280	3993	4634	11647	2912
N Total	1461	5511	10404	14156	31533	7884
N Mean *	487 a	1837 b	3468 c	4719 d	10511	2628

Columns with same letters are not significant at 0.05% level of significance

F-test for Nitrogen Levels = Highly Significant (HS)

F-test for variety = Not Significant (NS)

F-test for Nitrogen X Variety = Not Significant

CV (a) % = 54.3 %

CV (b) % = 24.1 %

LSD of Nitrogen 0.05 % = 1050 kg/ha

LSD of Nitrogen 0.01 % = 1430 kg/ha

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Table 2: Cost Benefit Ratio

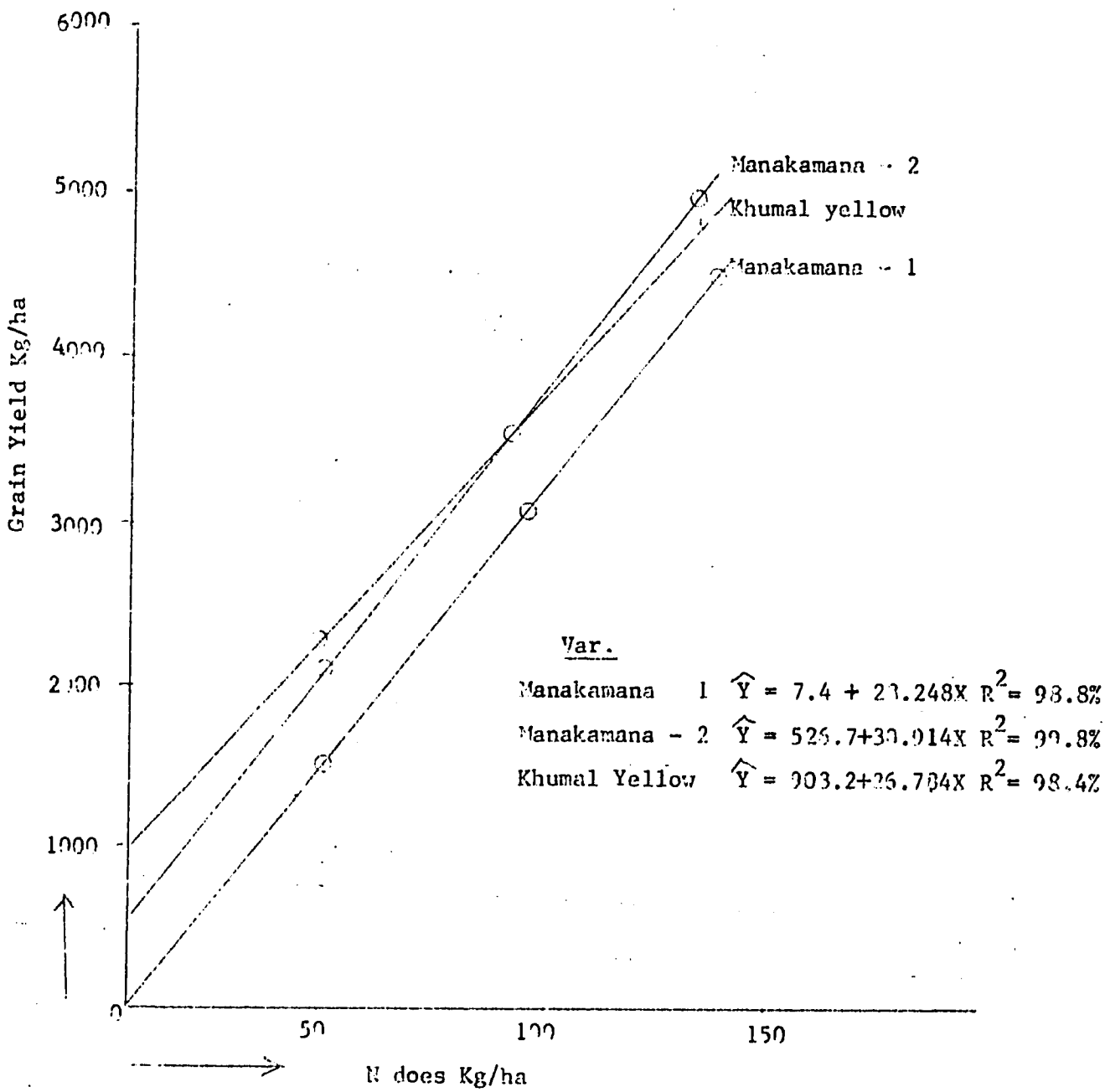
Variety	Nitrogen Doses kg/ha 50	100	150
Manakamana-1	1:5.184	1:7.03	1:8.3
Manakamana-2	1:9.67	1:9.80	1:9.06
Khumal Yellow	1:9.11	1:9.63	1:7.68
N Mean	7.99	8.82	6.35

Price of per kg maize @ Rs.2.25

Price of per kg N through Urea @ Rs.7.60

Figure 1.

Relationship between N Level and Grain Yield for different Maize Varieties



Identification of Yield Limiting Nutrient Elements in Maize Growing Soils of Chitwan Valley

S.P. Pandey*

INTRODUCTION

A wide occurrence of primary, secondary and micro-nutrient deficiency problem was recognized in the soils of Chitwan Valley (Khatri - Chhetri 1982). However, the field experimental results on the application of B as well as Zn in maize crop were not found much encouraging (Khatri - Chhetri, 1982 and Schmidt and Karna, 1977). Although an increase of 10-24 percent grain yield was obtained with soil application of 10-20 kg zinc sulphate / ha (Prasad, 1978).

It was observed that most of the previous field experiments were conducted without considering the supply of other soil deficient nutrient elements which might also be limiting the plant growth. Keeping the above mentioned point in view, a field experiment was conducted in Rampur Agriculture Station with the following objectives:

1. To identify the yield limiting nutrient elements
2. To compare the yield reduction due to non-application of one of the soil deficient nutrient element when all other limiting nutrients are adequately supplied.

MATERIALS AND METHODS

The experiment was conducted during 1983/1984 winter season in RCBD with 3 replications. Rampur Composite variety of maize was taken as the test variety with 8 different treatment combinations as sgown in Table 1.

Table 1: Treatment Combinations (kg/ha)

Treat. No.	N	P	K	Mg	S	Zn	B	Mo
1	100	20	40	30	30	10	2	0.5
2	100	20	40	30	30	10	2	0
3	100	20	40	30	30	10	0	0.5
4	100	20	40	30	30	0	2	0.5
5	100	20	40	30	0	10	2	0.5
6	100	20	40	0	30	10	2	0.5
7	100	20	40	0	0	0	0	0
8	0	0	0	0	0	0	0	0

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Three seeds per hill was dibbled at 75 cm X 25 cm apart in 8 rows of 5 meter length. After 20 days of germination, the seedlings were thinned to one plant per hill. Half of the N and all other nutrient elements were broadcasted as basal. The remaining ½ N was side-dressed at knee-high stage of the crop. The crop was weeded and irrigated as when needed.

The nutrient elements were supplied through the following chemical sources.

Nutrient Element	Source
1. N and P	Complesal (20-20-0), Urea (46)
2. K	Muriate of Potash (60% K_2O)
3. Mg	Magnesium Chloride (11.82% Mg)
4. S	Element Sulphus (99.9% S)
5. Zn	Zinc Carbonate (52 % Zn)
	Zinc Sulphate (22.60% Zn)
6. B	Borax (11.33% B)
7. Mo	Sodium Molydate (39% Mo)

RESULTS AND DISCUSSION

The mean grain yield data and the difference between the treatment means and standard control mean are presented in Table 2. Dunnet's test was used to compare the differences between the treatment means and the standard control mean. Here, the standard control mean is defined as the treatment supplied with all the nutrient elements under study.

Table 2: Differences With Respect to Standard Control

Treatments	Mean Grain Yield (kg/ha.)	Yield Difference W.R.T. Std. Control (kg/ha)	Percent Yield Difference
1. NPK MG SZn BMo (std. control)	5763	-	-
2. NPK Mg SZn B (- Mo)	5419	-344	- 6.0
3. NPK Mg SZn Mo (-B)	5126.	-637*	-11.0
4. NPK Mg S B Mo (-Zn)	6305	+542	+ 9.4
5. NPK Mg Zn B Mo (-S)	3916	-1847**	-32.0
6. NPK S Zn B Mo (- Mg)	6532	+769*	+13.0
7. NPK (-Mg S Zn B Mo)	2290	-3473**	-60.0
8. Native Fertility	1237	-4526**	-78.0

* - Significant at 5% level
** - Significant at 1% level
Dunnet Test: Co5 = 572 kg/ha, Co1 = 754 kg/ha, CV = 11.81%.

A perusal of the data in Table 2 reveals the following:

- The non application of boron significantly reduced the yield (637 kg/ha) by 11 percent in comparison to the standard control.
- The reduction of yield (1847 kg/ha) due to elimination of sulphur application was 32 percent and was highly significant.
- When none of the secondary and micronutrient elements were applied the yield reduction (3473 kg/ha) was by 60 percent W.R.T. standard control.
- When none of the nutrient elements were supplied the yield obtained under the native soil fertility condition was 1237 kg/ha, which was 78 percent (4526 kg/ha) lesser than the standard control.
- Whereas, the removal of magnesium from the standard control treatment significantly increased the grain yield (769 kg) by 13 percent.
- The deviation of yield from standard control due to not supplying Mo and Zn was found to be -344 and +542 kg/ha, respectively, and was not significant.

The above results show that in addition to the NPK, the other nutrient elements such as S and B might acutely limit the growth of the maize plants in Rampur Agriculture Station and other similar condition soils of Chitwan Valley. The results indicate a possibility of complex plant nutrition problem limiting or would be limiting the crop production in Chitwan Valley. Thus, priority should be accorded to the researches on soil fertility and plant nutrition management.

ACKNOWLEDGEMENT

The author is highly obliged to NMDP for providing the necessary facilities in conducting this experiment in Rampur Agriculture Station. He extends his sincere thanks to Mr. D.D. Neupane, Mr. S. Shrivastava and all NMDP staff, who extended their help directly or indirectly during the course of study.

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Discussion on Yield Limiting Nutrients element in Maize

B. Upadhyay : My question is related to rice. In 1984, general tip drying of leaf was observed in rice fields of the farmers in Chitwan Valley. As you have indicated general deficiency of micro-nutrients in maize, do you think that this tip drying may be micronutrients deficiency in Chitwan ?

Pandey : It cannot be said that tip drying may occur due to K-deficiency, diseases and drought.

Dr. M.P. Bharti : What was the pH of the soil ? The responses you got may be due to low soil pH. However, it is surprising that you got due response with Mg if the pH was low.

Pandey : The pH of the experimental plot was 4.5 to 5.0 I agree with your opinion.

Implications of Population Growth on Cereal Grain Production in Nepal "A Challenge to Nepalese Agriculture"

P.L. Chitrakar

Between (1965 - 1985) Nepal have almost completed Fourth Five Year Plan including the current Sixth Five Year Plan.

Inspite of successful implementation of Fourth Five Year Plans and their emphasis on agricultural development, the yields of major food grain crops have not increased rather they are decreasing during the past 20 years. Total estimated cereal grain production, during the past two decades, however, have increased not more than 1.5 percent per annum - a rate considerably below the population growth rate of 2.66 percent per year over the decade (1971-1981). Total cereal grain production was achieved by an expansion in the cultivated area by more than almost 2 percent per year during the same period causing yield to decline by more than 0.7 percent per year.

The performances trend of the major cereal crops during the last 20 years are given in the Appendix I to III.

The 1981 census gives a total population of 15.02 million with an average annual growths rate of 2.66 percent per year, whereas the food grain production is not increasing more than the rate of population growth in the country. This poses a challenge to Nepalese Agriculture and this challenge arises because per capita food grain availability is not increasing to the requirement of the people.

Nepalese are a heterogeneous group. This is more true in terms of their food habits. In general, inhabitants of the tarai usually get their caloric intake basically from rice, some wheat, vegetables and pulses. In the mid-hill region, people get their caloric intake basically from maize and millet and some pulses and little vegetable (except in the Kathmandu Valley where vegetables are taken in large quantities).

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* Ideas expressed herein are the personal opinion of the author who is an Agricultural Officer of RAD, Central Development Region, Kathmandu.

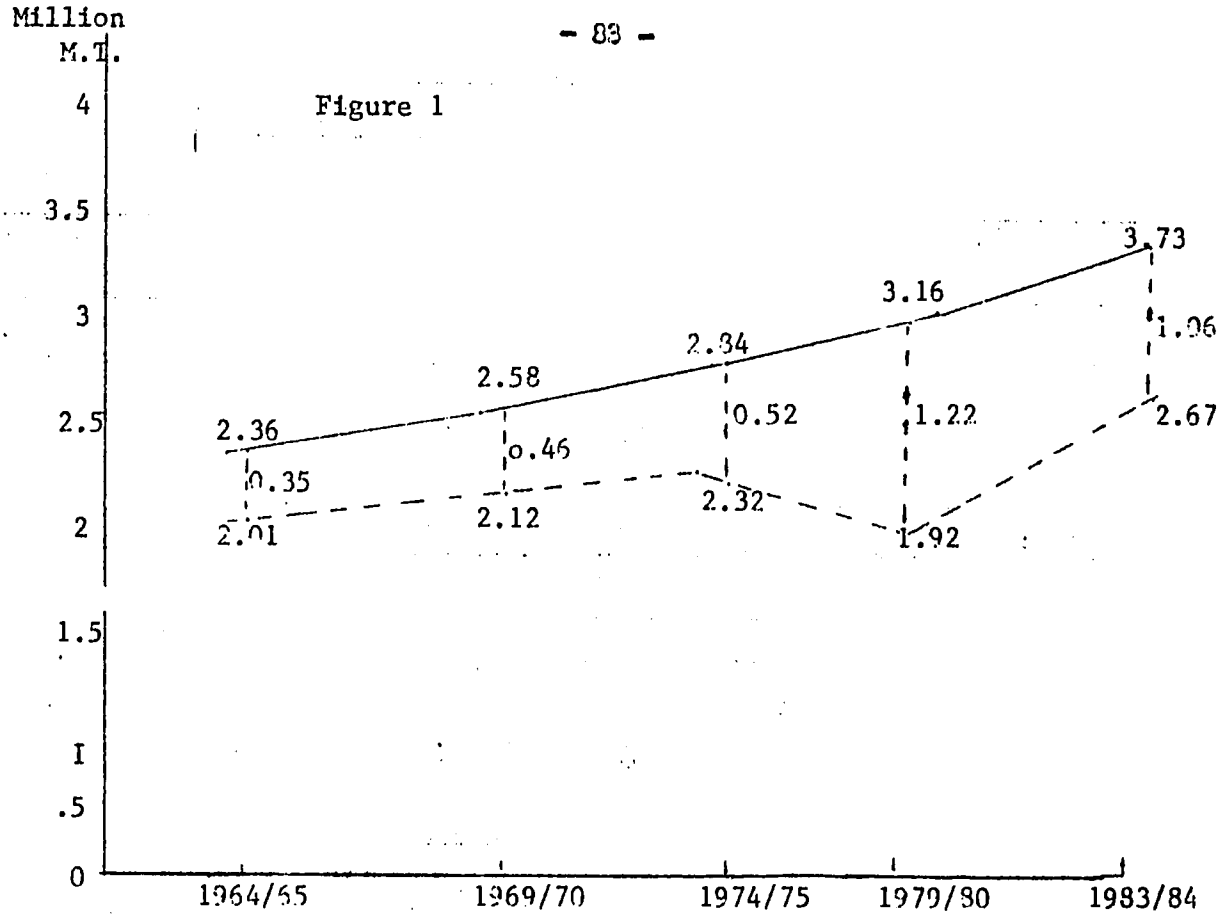
In the high moutain, people get their caloric intake basically from maize, millet, naked barley, buck wheat, potatoes and barley. Vegetable consumptions by inhabitants are limited.

During the base year of the Third Five Year Plan (1964/65), the estimated edible cereal grain production and total population estimated was 2.01 million metric ton and 10.27 million people respectively. Therefore, an average national per capita cereal grain availability was estimated 196 kg per year. In ther words, on an average a person eats .536 kg per day. Based on the caloric content of cereal grain, an average daily intake estimated is 2130 calories.

According to one estimate, an average standard calorie intake for a sedentary person is around 2000 calories per day. But Nepalese are not sedentary, they are active and are working. An average standard calorie intake for active individual's requirement estimated is 2500-3000 calories. And in meeting the minimum calorie requirement of 2500 calories from cereal grains alone, per day cereal grain availability is to increased from .536 kg to .630 :. Therefore, the net deficit of 94 grams or 370 calories are to be supplemented by supplementary intake of other food stuff such as sugar and milk in the tea, to provide minimum caloric requirements.

In the F.Y. 1983/1984, the estimated edible cereal grain production and total population estimated is 2.67 million metric ton and 16.24 million people respectively. This makes the per person per day availability only .449 kg leaving the deficit of 181 grams or 725 calories per person per day. This poses a challenge to Nepalese agriculture. The estimated cereal grain available and the cereal grain requirement is explained by the figure no. 1 below:

Figure 1



This figure explains that there exists a gap between the food requirement and their availability and this gap increasing over time. To minimize this gap is the challenge to Nepalese agriculture.

CONCLUSIONS AND OUTLOOK

Cereal grain consumption pattern differ from one area to another in Nepal. The consumption habits of Nepalese are, however, governed by traditional crops and their production in the area, availability of substitutes, prices of food products and per capita purchasing power of the people.

In Nepal, almost 94 percent of the people are engaged in agricultural persuit. The calorie requirements of Nepalese are to be met by the increased production and productivity of main cereal crops grown owing to the high prices of other food products, non-availability of substitutes and low purchasing power of the people.

Therefore, the solution to a challenge or to a food population crisis lies not only in increasing food production but also in reducing population and reducing the wasteful consumption by the existing population.

APPENDIX I

Production Trends of Major Cereal Crops

in 000 M.T.

Crops / F.Y.	1964/65	1969/70	1974/75	1979/80	1983/84
Paddy	2201	2241	2452	2059	2756
Maize	854	795	827	553	761
Wheat	126	265	331	439	633
Millet	63	125	140	119	114
Barley	26	24	26	23	22
Total :	3270	3450	3776	3193	4286
Index	100	105	115	97	131

Source: Agricultural Statistics Division, Kathmandu; 1964 - 1982 and 1984.

* - The production are in edible forms.
** - Food grains exported are not assessed.
*** - Food grains used towards the preparation of alcoholic drinks are not assessed.

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APPENDIX II

Productivity Trends of Major Cereal Crops

in kg/ha.

Crops / F.Y.	1964/65	1969/70	1974/75	1979/80	1983/84
Paddy	2001	1910	1978	1641	2066
Maize	1950	1836	1805	1280	1510
Wheat	1260	1173	1138	1199	1343
Millet	1520	1113	1118	975	927
Barley	1080	926	930	884	896
Total :	7811	6958	6969	5979	6742
Index	100	89	89	76	86

Source: Agricultural Statistics Division, Kathmandu; 1964 - 1982 and 1984.

APPENDIX III

Areas of Major Cereal Crops

in 000 ha.

F.Y. / Crops	1964/65	1969/70	1974/75	1979/80	1983/84
Paddy	1101	1173	1240	1254	1334
Maize	437	433	458	432	503
Wheat	100	226	291	366	471
Millet	96	112	125	122	123
Barley	24	26	28	26	24
Total :	1758	1970	2142	2200	2455
Index	100	112	121	125	139

Source: Agricultural Statistics Division, Kathmandu; 1964 - 1982 and 1984.

Effect of Maize and Soybean Intercropping on Insect-Pest Development at Khumaltar

Bhimsen K.C.*

ABSTRACT

The experiment was conducted at Khumaltar Entomology Farm during the summer season of 1984. It was planned to study the effect of maize and soybean monoculture and intercropped combination on insect-pest development of respective crop. Out of eight treatments, monoculture improved maize. Khumal Yellow received the highest borer infestation (18.0 %), produced more grain (5,944 kg/ha) and gave higher gross economic return (Rs.14,944/ha). The second highest GER (Rs.10,222/ha) was obtained in intercropped of maize with local soybean which was at par with MIM. Insect damage on soybean ranged from 20.1 to 36.6 percent but the difference was insignificant.

INTRODUCTION

Maize is an important crop of Nepal. It is grown in a variety of manner. Mostly, it is cultivated with soybean, fingermillet, upland rice, potatoes, ginger, radish, chillis, cowpea, peanut, and blackgram (Bharati and Neupane, 1980; Pathic et at, 1981, Sen and Sthapit, 1981). The companion crop either mixed with main crop or intercropped depending upon local practices of the farmers. However, the monoculture of maize crop and soybean are also expanding with the development of high yielding varieties.

Fourteen insect-pest of maize is identified (Sharma, 1983). Chemical weapon is widely used to combat with pest problem. As we know, the pesticide is an imported commodity. Its price and availability are not in our hand.

Hence, it is imperative to evolve some other pest control technology so as to meet the growing demand of our farmers. In this respect, an ecological approach will be the appropriate approach and can be accomplished by tailoring the crop environment. Crop environment or the agro-ecosystem can be modified with the kinds of crop, agronomic practices, change in land use, length of life of crop, and dominant vegetation. Thus, the crops of different canopy are

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selected and the present study was planned to understand the effect of maize and soybean intercropping environment on insect pest build-up of respective crop at Khumaltar condition.

MATERIALS AND METHODS

The experiment was conducted at Khumaltar Entomology Farm during the summer season of 1984. The design was Completely Randomized Block Design (CRBD) with 8 treatments and 4 replications. The plot size was 4 X 4.5 sq.m. where row to row and plant to plant spacing were 75 cm and 25 cm, respectively, in maize crop while in case of soybean crop, the row spacing was the same as in maize but plant spacing was kept 5 cm apart.

Khumal Yellow and Dhapakhel Local maize, Hardee and Thulo Bhatmas soybean, varieties were collected and treatment combination were made as below:

Treatment

1) Improved maize variety (Khumal Yellow), 2) Local maize (Dhapakhel Local), 3) Improved soybean variety (Hardee), 4) Local soybean (Thulo Bhatmas), 5) Improved maize + Improved soybean, 6) Improved maize + Local soybean, 7) Local maize + Improved soybean, and 8) Local maize + Local soybean.

The experimental crop was sown on 15th May, 1984. Agronomic practices were done as per need. Insect damage of maize and soybean plants were recorded on 25th June and 15th July, 1984. The percentage of insect infestation were calculated from the total plant count, and 5 randomly selected plant of plot in maize and soybean crop respectively. The percent infestation was transformed to angular value. The total grain yield of maize and soybean were combined in intercropping treatment and expressed as plot (18 sq.m.) and hectare basis. The gross economic return was assessed by using market value of maize (Rs.2.50/kg) and soybean (Rs.5.00/kg). Analysis of variance was done after Gomez (1976).

RESULTS AND DISCUSSIONS

Results of maize borer, Chilo partellus (Swinhoe) damage on maize crop, and soybean crop damage caused by Spilarctia casignata (Koll), Apion sp., Diaprromorpha deieanni, Hieroglyphus baniens, Monolepta signata, Epicauta hirtepes

etc. along with total maize and soybean grain yield (kg/ha) and gross economic return (Rs./ha) are presented in Table 1.

The highest cumulative mean of borer infestation (18.0 %) found in improved maize variety Khumal Yellow monoculture was significantly different for local Dhapakhel maize monoculture (9.7 %) and other maize and soybean intercrop combination. However, these latter treatments were not significantly different among themselves.

Insect damage of soybean crop ranged from 20 % to 36.8 % and statistically all the treatments revealed uniformity.

While considering about the total grain yield monoculture Khumal Yellow gave the highest yield (5,944 kg/ha) which was at par with local maize grown as a sole crop (4,000 kg/ha). Again it differed significantly with other soybean sole crop and inter-cropping of maize and soybean. Further, it gave the highest economic return (Rs.14,944/ha) over the rest of other treatments. The lowest GER was obtained in local soybean monoculture but was at par with intercropping of local maize with other two types of soybean.

CONCLUSIONS

From the above results, the following conclusions can be drawn out:

1) Improved maize and soybean varieties suffered more insect damage as compared to other treatments.

2) Lower insect damage in intercropping treatment may be associated with the micro-environment created by maize and soybean intercropping.

3) Agro-ecological studies will be potential area for future research program.

ACKNOWLEDGEMENTS

The author is grateful to Dr. Keshav Chandra Sharma, Chief, Division of Entomology, for providing necessary facilities needed to this experiment. Special thanks goes to Mr. Noor Kumar Khatri, Assistant Entomologist who took pain to identify the insects collected from the experimental field. The help

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Table 1: Effect of Maize and Soybean Intercropping on Insect-Pest Development, Total Grain Yield Production And Gross Economic Return

Sl. No.	Treatment	Insect Damage % on Total Grain Yield				Gross Economic Return	
		Maize	Soybean	kg/Plot	kg/ha	Rs/Plot	Rs/ha
01.	Improved Maize (Khumal Yellow)	18.0 (25.1) a	-	10.7 a	5944	26.7 a	14,944
02.	Local Maize (Dhapakhal Local)	9.7 (18.1) b	-	7.2 ab	4000	18.0 ab	10,000
03.	Improved Soybean (Hardee)	-	36.6 (37.2) a	2.6 cd	1444	13.0 b	7,333
04.	Local Soybean (Thulo Bhatmas)	-	31.5 (34.1) a	1.8 d	1000	9.0 b	5,000
05.	Imp. Maize+Imp. Soybean	11.5 (19.8) b	28.9 (32.5) a	5.4 bcd	3000	18.0 ab	10,055
06.	Imp. Maize + Local Soybean	10.8 (19.1) b	20.1 (26.6) a	6.0 bc	3333	17.3 ab	10,222
07.	Local Maize+Imp. Soybean	9.0 (17.4) b	27.0 (31.3) a	6.0 bc	3333	18.4 ab	9,611
08.	Local Maize+Local Soybean	8.4 (16.8) b	25.5 (30.3) a	4.0 bcd	2222	12.0 b	6,667

- Mean of 4 replications of plot size 4 X 4.5 square meter.
- Insect damage is the cumulative mean of two observations recorded on 25th June and 15th July, 1984.
- Data within the parenthesis indicates the angular value of percentage data.
- Means followed by the same letter are not significantly different at 0.05 level of significance.

Discussion on Intercropping Effect on Insect Pest Development

J.P. Tamulonis : In Table 1 of your intercropping experiment you havn't mentioned the C.V. in your experiment, what was it ?

K.C. : Yes. C.V. Was not calculated.

Table 1: Effect of Maize and Soybean Inter-Cropping on Insect pest Development, Total Grain Yield Production and Gross Economic Return

S.No.	Treatment	Insect damage % on		Total Grain Yield		Gross Eco.Return	
		Maize	Soybean	Kg/plot	Kg/ha	Rs/plot	Rs/ha
1.	Imp. maize (Khumal Yellow)	18.8(25.1)a	-	1[illegible].7[illegible]	5,944	26.7a	14,944
2.	Local maize (Dhapakhal Local)	9.7(18.1)b	-	7.2ab	4,000	18.0ab	10,000
3.	Imp. Soybean (Hardee)	-	36.6(37.2)a	2.6 cd	1,444	13.0b	7,333
4.	Loc. Soybean(Thulo Bhatmas)	-	31.5(34.1)a	1.0d	1,000	9.0b	5,000
5.	Imp. Maize+Imp.Soybean	11.5(19.0)b	28.9(32.5)a	5.4bcd	3,000	18.0ab	10,055
6.	Imp. maize+Local Soybean	10.8(19.1)b	20.1(26.6)a	6.0bc	3,333	17.3ab	10,222
7.	Local Maize+Imp. Soybean	9.0(17.4)b	27.0(31.3)a	6.0bc	3,333	18.4ab	9,611
8.	Local Maize+Local Soybean	8.4(16.6)b	25.5(30.3)a	4.0bcd	2,222	12.0b	6,667

-Mean of 4 replications of plot size 4 x 4.5 sq.m.

-Insect damage is the cumulative mean of two observations recorded on 25th June and 15th July, 1984.

-Data within the parenthesis indicates the angular value of percentage data.

Means followed by the same letter are not significantly different at 0.05 level of significance by DMRT test.

Selection For Cob Rot Resistance in Maize - 1984

Cob or ear rot of maize is one of the most serious problems at high and mid-hills of Nepal. Most of the improved genotypes of maize are highly susceptible to cob rot, caused by Fusarium moniliforme, whereas Kakani local is highly resistant to this disease. The damage due to this disease is very high and Nepalese farmers will not accept cob rot susceptible maize varieties. So it is the urgent need to develop a cob rot resistant maize genotypes for our condition.

To achieve the above objective, a joint effort was made by Plant Pathology Division, Kakani Agriculture Farm and National Maize Development Program. Kakani Local variety was taken as the source of resistant material. In 1979-80, ten recommended and promising varieties were crossed with Kakani Local as female. Again in 1980-81, the F_1 materials were back crossed with improved genotypes as the male parents. These materials were selfed and S_1 lines were produced during 1982-1983 at Khumaltar. These S_1 materials were grown at Kakani in 1983-1984 and, they were crossed with bulk pollens of Kakani Yellow, Ganesh-2, Manakamana-2, Rampur-2, Arun-4, Arun-2, Rampur-1, Rampur Composite, Khumal Yellow and Sarlahi Seto. During this period only 15 crosses were selected for further crossing, selection, evaluation and improvement.

Fifteen crosses were planted at Khumaltar during 1984 summer. The artificial inoculation of Fusarium moniliforme was done after dough stage. The plot size was 5 rows of 5 meter long and only one replication was used. The grain yield was computed on the basis of net harvested area; and it was adjusted to 15% moisture. Some of the ears from each entry were selfed forseed purpose.

The summary of the observations are given in Table-1. There was some difference in yield among different crosses but there was no mark different in days to 50% silking, plant and ear heights. There was no incidence of cob rot in any entry. However, this needs to be confirmed by further testing at the optimum condition.

Table 1: Selection for Cob Rot Resistant of Maize - 1984

S.No.	Pedigree	Yield kg/ha	Days to 50% Sinking	Height in cm		Lodgin %		Cob rot %	Remarks
				Plant	Ear	Root	stalk		
1.	Kakani Local x Khumal Yellow 12	3035	73	232	127	3	9	-	
2.	" " 22	4351	72	222	1[illegible]	2	11	-	
3.	" " 32	5273	73	2[illegible]	141	1[illegible]	12	-	
4.	" " 42	5[illegible]2	73	252	145	14	5	-	
5.	" " 102	5530	72	2[illegible]	1[illegible]	5	-	-	
6.	" " 152	3427	75	245	151	12	5	-	
7.	" " 182	3506	72	250	15[illegible]	7	10	-	
8.	" " 222	4017	72	257	14[illegible]	14	10	-	
9.	" " 312	5142	7[illegible]	262	13[illegible]	10	5	-	
10.	" " 14	5340	71	253	132	13	9	-	
11.	" " 64	5116	7[illegible]	235	116	11	3	-	
12.	" x Thai Composite	3702.	75	227	127	14	8	-	
13.	" x Hetauda Composite	3233	75	251	144	9	3	-	
14.	" x Khumal Yellow 12	4616	72	23[illegible]	125	3	3	-	
15.	Khumal Yellow 5 Lb.	5706	72	259	140	2	12	-	

Efficacy Of Fungicides Against Head Smut of Maize

G. Gurung,
K.L. Manandhar &
B.K. Batsa*

ABSTRACT

Five fungicides were tested against head smut of maize. Of the tested fungicides, Vitavax-200 completely controlled the disease and other four, Bavistin, Thiram, Brassicol and Captan also reduced the incidence of the disease significantly.

INTRODUCTION

The incidence of Smut on maize has been reported since 1967 It was first recorded from Ilam. The disease occurs throughout the country mostly in hilly regions. In most of the parts, the intensity of smut is estimated about one percent (Manandhar, K.L. 1983) and also the loss in yield caused due to the disease was not observed (Shah 1968). Three Smut pathogens were known to infect maize plant inducing False smut by Ustilaginoidea Virens (Cke) Tak, Head Smut by Sphacelotheca reliana (Kuhn) Clinton and Common smut by Ustilago maydis (D.C.) Corda. Of these the most destructive Head smut prevails both in hill and high hill causing greater loss in yield in certain areas.

High incidence of head smut was reported from different parts of the districts Dolakha, Terahthum, Lalitpur, Nuwakot from time ti time. The disease being destructive has caused greater problem for maize growers of those locations.

It is both seed and soil borne in nature. The infection by Sphacelotheca reliana is systematic and appears only after tasseling to harvesting stages of the host. It attacks tassel and ears and eventually convert those organs into smut. The galls at first are covered with membrane which at later stages ruptures exposing black powder of spores. The presence of hard conductive fibres inside the smutted cobs and in the smutted tassel is its characteristics feature.

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The climatic condition is also one of the main factor in determining the incidence of head smut. In a study, under favorable condition the temperature range required for spore germination was observed min 12-13 °C max 37-38 °C with optimum 24-25 °C (Juhasova, 1969). However, seed treatment with Zinc sulphate had reduced the incidence of disease (Azimov, A.S. 1968). Chemical control through seed treatment was observed by Sanduville et al in 1964. By the application of PCNB to the soil also controlled the disease (Simpson, W.R. and Fenwick, H.S. 1968). The increased infection of the disease was observed in fields where maize was grown for 5-6 years as monoculture (Papov, A. 1968). M. Delassus in 1968 succeeded to reduce the disease effectively by destroying infected plants. Regarding the susceptibility of the disease among varieties, Khumal Yellow, Kakani Yellow, Kakani Local, Manakamana and Rampur Composite were known. The present study involves the chemical control method by seed treatment. The trial was conducted in farmer's field (Dolakha, Kakani) known naturally infected with smut in the previous year and the seed was artificially inoculated with viable smut spores.

MATERIALS AND METHODS

The trial was laid out in a completely randomized design with four replications. The plot size 9 meter square with spacing 25 x 75 cm. The fertilizer applied was 90:45:0 kg of NPK per hectare of which half amount of nitrogen was given at knee high stage. The seed of test variety Kakani Yellow was inoculated with spores and then treated with following fungicides one week before sowing.

S.No.	Fungicides	gm Per kg of Seed
1	Vitavax-200	3
2	Bavistin	2
3	Brassicol	2
4	Captan	2
5	Thiride	2
6	Control	0

The treated seed was sown in the first week of Baisakh. The prevalence of the disease was recorded at the time of harvest on the basis of the number of smutted and smut-free plants. The data observed in Dolakha was statistically analyzed and presented in the table. (The result from Kakani was found not significant.)

RESULTS AND DISCUSSION

This study is the first attempt to find out the chemical control for smut. In the test, seed treatment was found effective against head smut. The incidence of smut in control plot was (2.5% which was completely swept out (00%) in plot treated with Vitavax-200. In the experiment, fungicidal effect showed statistically significant over control plot.

S.N.	Fungicides	Mean (Sq.Root Trans.)	Mean (Converted)	Mean (Original/ 80 Plants	% of dis-incidence
1.	Vitavax	0.71	0.004 [a]	0.0	00
2.	Bavistin	0.78	0.11 [a]	0.25	1.25
3.	Thiram	0.78	0.11 [a]	0.25	1.25
4.	Brassicol	0.86	0.24 [a]	0.50	2.5
5.	Captan	1.00	0.50 [a]	1.00	5.0
6.	Control	1.56	1.93 [b]	2.5	12.5

L.S.D. 0.05 = 0.45; CV = 31%

The effect of Captan was least among the chemicals used. Equal effectiveness was observed in plots treated with Bavistin and Thiram. The effect of Brassicol was more than that of Captan. Thus Vitavax-200 was the best for the control and others were also effective against disease.

Hence it can be concluded that the incidence of head smut in severe areas can be easily controlled by chemical though seed treatment.

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Regional Report on Summer Crops
Eastern Development Region, Biratnagar

Kedar P. Upadhyaya*

Rice and maize are the two major summer crops grown in this development region. In addition to these crops, millet, groundnut, blackgram, greengram, soybeans and other leguminous crops are also successfully grown in the potential areas. Rice is the staple food of tarai whereas maize occupies the place of main food in all the hill districts.

REPORT ON RICE

Rice is the leading cereal grain grown in all the districts of the region, although the area under this crop varies markedly from district to district especially in hills. Most of the rice growing areas of the region are concentrated in five districts of tarai viz. Jhapa, Morang, Sunsari, Saptari and Siraha.

Total area covered under improved rice cultivation in this region in the Fiscal Year 2039/2040 and 2040/2041 were 101788 hectares and 146722 hectares, respectively, whereas the target to be fulfilled by this crop in this Fiscal Year is 155520 hectares. From these figures it looks that the area under improved rice cultivation is increasing year after year.

Masuli, IR-20, IR-9729, CH-45, Sabitri, Janaki and Chandina are the main popular varieties of this crop. Masuli is almost saturated in all rice growing areas because of its higher adaptability and suitability of agro-climatic conditions. B-44-b (Kisan Dhan) is proving itself a distinguishing variety of rice in tarai districts despite the fact that it has been recognized and approved by variety release committee. Some local varieties like Basmati, Biramful and Bhadaiya are also grown to a considerable extent in tarai as well as in hills.

REPORT ON MAIZE

Maize is the second cereal crop grown to a greater or less extent in all the 16 districts of this region. Total area covered under improved maize in

* - Agricultural Officer.

the Fiscal Year 2039/2040 and 2040/2041 were 21622 hectares and 42075 hectares, respectively, and the area to be covered in this Fiscal Year 2041/2042 is 11316 hectares.

So far as the choice of the farmers in connection with varieties is concerned Khumal Pahenlo, Rampur Pahenlo, Hetauda Composite and Rampur Composite are widely adopted in suitable localities of the region. Rampur Composite in terai and Khumal Pahenlo in mid-hills have proved themselves the outstanding varieties. Among the local varieties Sathiya is very much popular among the farmers because of its short duration in maturity.

REPORT ON MILLET AND OTHER SUMMER CROPS

Fingermillet is the third major summer crop grown on hill districts and consumed as food locally, although it is consumed in different forms. This cereal is mostly cultivated as mixed crop with maize, so ybean etc. but it is also cultivated singly in rice field (Khet Land) where irrigation facilities are available. As the improved varieties are in short supply, the farmers are growing local varieties. Among other summer crops sugarcane and different types of legumes are also grown. The total area covered under improved millet in the Fiscal Year 2039/2040 and 2040/2041 were 4100 hectares and 1149 hectares, respectively, whereas the target to be fulfilled in this Fiscal Year is 3567.50 ha.

EXTENSION ACTIVITIES

There are 16 districts in this region. In each and every district there is Agriculture Section under District Office in order to look after all agriculture development and extension activities. The main objective of these Agriculture Sections is to disseminate the relevant, accurate and timely technical know-how to the concerned districts through different extension teaching methods. Result demonstrations, method demonstrations, production demonstrations and minikit demonstrations have become much more effective in convincing the farmers about improved farm practices. In order to diffuse the improved farm technology, the Agricultural Sections of the districts have been organizing different types of district and village level trainings, farmers' field visits, farmers day, group discussions, fairs and exhibitions and distribution of farm publications are other regular activities carried out in the districts. Most of these activities are accomplished by extension workers especially by JTs/JTAs who are the main agents to stimulate the farmers. Distribution of seedbeans to a few progressive

farmers at subsidised price has been a new innovation to them.

IRRIGATION PROJECTS

There are four important irrigation projects in this region: Kankai, Sunsari-Morang, Chandra Nahar and Komala. These projects are estimated to irrigate approximate one thousand hectares of land on completion of their construction and renovation works. Sunsari-Morang Irrigation Project is estimated to irrigate 66000 ha. of land after its completion, out of which 43000 ha are being already irrigated for 3 years. Kankai Irrigation Project is providing water in all the seasons to its command area. Its irrigated area is little above 5000 ha. in rainy season and 2000 ha. in winter, Komala (Eastern Canal) is irrigating North-Western area of district for last 5 years. Chandra Nahar works mainly season and to a very little extent in winter and the area irrigated in farmer season is 10000 hectares.

DEVELOPMENT PROJECTS

As new approaches to rural development, some projects have been launched in this region with a view to providing quick satisfaction to the dissatisfied people. The names of these projects and their area of coverage are as follows:

1. Sagarmatha Integrated Rural Development Project

   This project has been financed and supported by ADB/N and it covers Saptari, Siraha and Udaipur districts of Sagarmatha Zone.

2. Training and Visit System

   It is being financed and supported by World Bank and it covers Morang, Sunsari and Jhapa districts.

3. Koshi Hill Area Rural Development Project

   It is being financed and supported by British Aid. It covers Dhankuta, Terahthum, Sankhuwasabha and Dhojpur districts. It has already passed the prefixed period and as it was lagging considerably in fixed target achievement a reasonable additional period has been sanctioned so that the prefixed targets could be achieved. Pocket Area Development Approach to the rural development through concentration and coordination of efforts is claimed by its advocates to be the outstanding feature of this project.

MAJOR CONSTRAINTS

Major obstacles faced mainly in connection with maize and rice cultivation are as follows:

1. Unavailability of desired variety and quality seeds of maize and millet in time.

2. Lack of the technical know-how and understanding in the farmers to reduce and minimize the post harvest losses of the summer crops.

3. Unavailability of the required insecticides, pesticides and other plant protection measures to farmers right time and in fair price.

4. Delay in the release of the budgets for the program in question.

5. Much of the summer crops have to be still grown under rainfed conditions.

6. Hail-storms in case of maize in higher altitudes and heavy rainfall and prolonged drought in case of summer maize and the millet can also be considered to be the serious problems.

7. Lack of organized markets for the produce of these crops.

SUMMARY AND CONCLUSION

There is still sufficient scope for the cultivation, expansion and improvement of maize, millet and rice both in tarai and mid-hills. By bringing Tahar areas (flat lands) lying beside the Arun, the farmer and the Sunkoshi under irrigation, we can do a lot in expanding the area and in increasing the production of these crops and in coping with fast changing situation in ever growing need of the farmers.

Regional Report on Summer Crops
Central Development Region

H.B. Shrestha*

Central Development Region embraces 19 districts scattered in three different ecological regions namely tarai, mid-hills and higher hills. The major summer crops of the region are paddy, maize, fingermillet, mungbean, blackgram, arhar, pigeon pea etc. The leading crop is paddy in tarai and maize and millet in hills. Owing to lack of reliable information pulses and oil seed crops are not highlighted.

Sixth Five Year Plan accorded top most priority to agriculture sector and greater proportion of the national budget is being earmarked to this sector. Desperate efforts have been made to increase foodgrain production and emphasis was placed on developing and popularizing modern varieties as a part of this drive. In central development region alone ninteen district agricultural development offices are involved together with agricultural research farms and other allied agencies to improve food production. Moreover, it is very important to note that more than seven foreign aided projects which are listed below are engaged in agricultural development activities for last so many years:

1. JADP (Janakpur Zone Agriculture Development Project)

   The project that helped / strengthen the agricultural extension activities of Dhanusha, Mahottari, Sarlahi, Sindhuli and Ramechhap. The project is already at the final stage.

2. AERP (Agricultural Extension and Research Project)

   This is the project run with the help of World Bank fund and engaged to help improve the extension activities in Dhanusha, Mahottari, Sarlahi and Chitwan. At the same time it is also providing some supports to the farms.

3. Rasuwa-Nuwakot Project

   The first phase of the project is already over and second phase is going to be implemented from the Fiscal Year 1985/86. The project has its

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program running in Rasuwa and Nuwakot districts aiming to improve overall agricultural production.

4. Narayani Zone Irrigation Development Project (NZIDP)

The project intends to increase the irrigated area and agricultural production through training and visit systems.

5. Production Program (P)

Cropping systems based production program is launched in Bara, Parsa, Rautahat, Dhanusha, Sarlahi and Chitwan districts. Its aim is to increase productivity of land by more than seven metric tons per hectare per year.

6. GTZ Project

GTZ has also contributed some inputs in accelerating agricultural development program of Dhading district.

7. IHDP (Integrated Hill Development Project)

The project is in full swing for last 10 years. The project has emphasized in implementation of production oriented program through the aid of Tukis.

8. There are certain new projects coming up like SINKALAMA which will help in improving and increasing agricultural production in Sindhupalchowk, Kabhre, Lalitpur and Makwanpur districts.

Inspite of so much of efforts being made by the projects, government offices and other allied agencies its outcome is not up to our expectation and target laid-down in periodic plans.

Area, production and productivity for paddy, maize and millet by ecological zones for central development region for last 9 years are presented in Tables 1, 2 and 3 respectively. Percent increase in production of these crops in 1983/84 over the production obtained in 1975/76 is shown in Table 4. There is slight increase in area (7%) under paddy in last 9 years in this region. However, the area covered by modern paddy variety remains around 30 percent. The paddy output and yield is not so bad. There is gradual increase in paddy production in last 9 years except in 1982/83. Total production counts to 21

percent increase in 1983/84 compared to production achieved in 1975/76 annual increase of 2.3 percent. Yield increased was recorded at 12 percent during the same period.

However, if we look at the picture by ecological regions the increase in total production came from tarai and mid-hill. The total production of paddy in higher hills is not impressive. Increased paddy production in mid-hill is contributed by increased in new area under rice cultivation, but the productivity dropped by 16 percent. In case of higher hills, inspite of increase in area the total production and productivity went down by 9 percent and 16 percent respectively.

Production of maize in the central development region is quite erratic. The data available shows that total production of maize increased by about 7 percent in 1983/84 compared to 1975/76 level. It means, in average, annual increase in production is less than one percent. There is more than 18 percent area increased under maize during same period. Thus, increase in production is totally contributed by increase in area. The productivity shows 8 percent decline as compared to 1975/76 level. It clears that the maize production trend was not impressive during last 9 years.

While looking at the figure by ecological regions, the maize production in tarai increased by 42 percent which is quite encouraging. The production situation in mid-hills and higher hills are disappointing. The achievement in 1983/84 failed to maintain the production and productivity level of 1975/76, while area under the crop increased in both the ecological regions.

Regarding millet, its area went down by 15 percent production decreased by 18 percent at the same time productivity dropped by 2.7 percent in last 9 years. The performance of the crop is poor in all ecological zones except at higher hills, where slight increase in production and productivity is observed.

There could be a number of reasons for poor crop performances like lack of coordination among the agencies concern, lack in inputs availability and, of course, lack of suitable technologies available to the farmers. All these bring the widening gap between target laid-down and achievements made. Here I would like to go a little deep into third point, that is availability of suitable technologies.

From the data it is clear that the crop performances are poor mainly in hills and higher hills. It is partly because suitable technologies are not available to them. The efforts are being made in developing suitable varieties and other technologies mainly for irrigated and tarai condition. A little attention is paid in developing suitable technologies for hills and higher hills. It is true that positive and quick results can be expected by working in tarai condition, where better irrigation and transportation facilities exist. Moreover, the agricultural inputs like fertilizer, seeds and chemicals etc. can easily be taken there.

However, the realities of present situation in hills and mountain with its rising population and declining food productivity calls for determined efforts to introduce a suitable agricultural technologies. Inspite of limited potentiality for agricultural development due to rugged topography, limited accessibility and constraints to inputs supply, more research works need to be focused to the hills and mountains. If we have to feed increasing population, reduce migration and overcome increasing food distribution problem, our efforts must also be diverted for increased crop production in hills and mountains. This also brings equality and balance growth of agricultural development in the country.

Table 1: Area, Production and Average Yield of Paddy

Area in hectare
Production in Metric Ton

	1975/76	'76/77	'77/78	'78/79	'79/80	'80/81	'81/82	'82/83	1983/84
High Hills									
1. Area	6050	6050	6360	6120	6050	5870	6080	6430	6580
2. Production	12640	13725	11479	12250	10860	10780	11260	12490	11410
3. Productivity	2.08	2.26	1.80	2.00	1.79	1.83	1.85	1.94	1.734
Mid-Hills									
1. Area	58850	61801	66100	64700	64890	67200	70990	85550	84510
2. Production	188250	186756	189060	185860	161960	169390	207540	212610	225550
3. Productivity	3.19	3.02	2.86	2.87	2.49	2.52	2.92	2.48	2.66
Terai									
1. Area	340510	342702	355790	342950	343480	341570	341260	314900	344910
2. Production	659570	562134	545750	592660	607370	651450	741900	347980	805830
Productivity	1.93	1.64	1.53	1.72	1.76	1.90	2.17	1.10	2.34
Region									
1. Area	405410	410553	428250	413770	414420	414640	418330	406880	436000
2. Production	860460	726615	746289	790770	780190	831620	960700	573080	1042790
3. Productivity	2.12	1.86	1.74	1.91	1.88	2.00	2.29	1.40	2.39

Source: Agricultural Statistics of Nepal, 1983, 1984.

Table 2: Area, Production and Average Yield of Maize

Area in hectare
Production in M.Ton

	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/1984
High Hills									
1. Area	14620	14625	14620	14920	14920	12820	14500	13500	14990
2. Production	28100	27646	24680	22180	18160	19640	22500	19960	18380
3. Productivity	1.92	1.8	1.6	1.4	1.2	1.5	1.5	1.4	1.23
Mid-Hills									
1. Area	79790	79669	75660	80750	73530	75420	88980	90500	97210
2. Production	146240	148838	132128	137730	101160	130318	152940	138980	139670
3. Productivity	1.83	1.86	1.74	1.71	1.38	1.73	1.72	1.54	1.436
Tarai									
1. Area	49880	46951	43200	43000	38080	43630	45040	57220	58670
2. Production	78800	80880	78010	65450	30600	73090	78380	90740	112430
3. Productivity	1.57	1.72	1.80	1.52	0.80	1.62	1.74	1.58	1.916
Region									
1. Area	144290	141245	133480	138670	126530	131870	148520	161220	170870
2. Production	253140	257364	234818	225360	149920	223048	253820	249680	270480
3. Productivity	1.73	1.82	1.75	1.62	1.18	1.69	1.70	1.54	1.58

Source: Agricultural Statistics of Nepal, 1983, 1984.

Table 3:

Area, Production and Average Yield of Millet

Area in hectare
Production in MT

	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/1984
High-Hill									
1. Area	4110	4030	3920	4310	4310	4090	4090	3950	3950
2. Production	3650	4560	3820	4200	3990	3850	3866	4050	3840
3. Productivity	0.38	1.13	0.97	0.97	0.92	0.94	0.94	1.0	0.972
Mid-Hills									
1. Area	18444	17808	16830	15480	15450	15640	16540	14050	14490
2. Production	18018	20811	17748	17330	16040	15960	15880	13200	13480
3. Productivity	0.97	1.16	1.05	1.11	1.03	1.02	0.96	0.93	0.93
Tarai									
1. Area	7190	7520	7250	7160	6930	7380	7636	9270	6610
2. Production	7070	6300	5860	5750	5880	6970	6670	8770	6090
3. Productivity	0.98	0.83	0.82	0.80	0.84	0.94	0.87	0.84	0.92
Region									
1. Area	290744	29358	28000	26950	26690	27110	28266	27270	25050
2. Production	28738	31671	27428	27280	25910	26780	26416	26020	23410
3. Productivity	.96	1.07	0.97	1.01	0.97	0.98	0.93	0.95	0.934

Source: Agricultural Statistics of Nepal, 1983, 1984

Table 4: Percentage Change in Crop Area, Production and Productivity in 1983/84 Compared to Base Year 1975 / 1976

	Area (ha)	Production (MT)	Productivity
PADDY			
High Hill	8.76	-9.73	-16.63
Mid Hill	43.60	19.8	-16.62
Tarai	1.29	22.17	21.24
Total	7.54	21.18	12.73
MAIZE			
High Hill	2.53	-34.6	-35.27
Mid Hill	21.83	- 4.50	-21.53
Tarai	17.62	42.6	22.03
Total	18.42	6.8	- 8.67
MILLET			
High Hill	-3.9	5.2	10.45
Mid Hill	-21.44	-25.19	- 4.13
Tarai	- 8.07	-13.87	- 6.13
Total	-15.79	-18.54	- 2.71

- Computation based on Tables 1, 2 and 3.

Regional Report On Summer Crops
Western Development Region

K.J. Gurung*

Western Development Region Comprises 16 districts. Among them two are in high hill, 11 are mid-hills and 3 are in tarai region. The total area of the region is 28445 sq.km.

The major summer crops grown in this region include rice, maize and finger-millet. Apart from these, crops like green gram, black gram, groundnut, sugar-cane are also grown as summer crops.

REPORT ON RICE

Rice is the predominant staple food in rice growing areas especially the tarai districts. More than 75% of the rice areas of the region are concentrated in the tarai districts like Kapilvastu, Rupandehi and Nawalparasi, whereas the other districts of the hill are unable to meet their requirement. Out of 16 districts in the region, Manang and Mustang do not grow rice due to unsuitability of agro-climatic condition.

The main improved varieties which are very popular among the farmers are Masuli, Laxmi, Janaki, Sabitri, CH 45, Chandina, IR 20, T-176 and K-39. Among them Masuli is grown in all the tarai valley as well as in lower elevations in the hills and in river basin of the hills. Himali and Kanchan variety of rice has also shown good performance in Lamjung district. So, these varieties may replace Masuli in Lamjung. Beside the improved varieties some local varieties are also very popular in the region, like Pokhreli Masino, Basmati, Kalanimak, Jhimuwa, Pahale and Gudura. But those varieties has low yield as compared to improved varieties.

The total area under improved rice varieties shows the gradual increasing trend in the following fiscal years.

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* Assistant Agricultural Officer

Fiscal Year	Hectarage Covered
1979/1980	64553
1980/1981	65345
1981/1982	69621
1982/1983	74660
1983/1984	85225 (Production 209108 MT)
1984/1985	88491.52 (Production 237557.12 MT)
1985/1986	95050 (Production 248990 MT) (Proposed Target)

REPORT ON MAIZE

Maize is considered as one of the most important food grains of the region, especially in the mid hill. Maize is grown in all 16 districts of the region. The important maize growing districts of the region based on hectarage are Kaski, Gorkha, Lamjung, Tanahun, Syangja, Gulmi and Parbat in the mid hills and Nawalparasi in tarai districts. The popular maize varieties grown in the region are Kakani Yellow (higher hills), Khumal Yellow (mid hills), Rampur Yellow. Rampur Composite (tarai districts). Arun (short duration) variety of maize has been successful in the tarai and mid hill of the region. The popular local varieties grown in the region are Sathia, local yellow and local large. Among the local varieties "Sathia" is popular because of its maturity in short duration. In recent years, winter maize is becoming popular in some of the region: Nawalparasi, Rupandehi, Kaski, Tanahun, Gorkha and Syangja districts are the main winter maize growing districts of the region.

The total area under improved maize - cultivation is in the gradual increasing trend.

Fiscal Year	Hectarage Covered
1979/1980	30282
1980/1981	32450
1981/1982	31838
1982/1983	34340 (Production 60892 MT)
1983/1984	37609 (Production 64226 MT)
1984/1985	36119.35 (" 74916.3 MT)
1985/1986	40280 (" 84099 MT) (Proposed Target)

OTHER SUMMER CROPS

In the hills the fingermillet occupied third position as a major summer crops. This is grown both as mixed and single crop. The main improved varieties which are popular among the farmers are Dalle and Okhale. The popular local varieties are Kartike Kodo (which ripens in the month of Mangshir). The target of fingermillet in this fiscal year is 2875 ha. In last fiscal year, the target of fingermillet was 330.3 ha and production was 214 MT. Groundnut, green gram, black gram, and sugarcane are the other important summer crops in the region and they are consumed locally.

SEED MULTIPLICATION PROGRAM

Seed multiplication program has been conducted in some of the districts mainly for wheat and maize. To preserve the good seed the seed bins have been distributed to the farmers of remote hilly village on the experimental basis. In this running fiscal year 50 seed bins is going to be distribute in the Myagdi and Gorkha districts. This program is being continued in the current fiscal year also. This program is conducted with the coordination of Agricultural Inputs Corporation.

OBSERVATION AND SUGGESTIONS

1. Unavailability of inputs such as seeds and fertilizers, insecticide and fungicides in required quantity in time is a great drawbacks to achieve the target, as for instance, in some hilly districts (Parbat, Lamjung and Gorkha) the lack of insecticide caused severe loss in maize due to attack of army worm.

2. Irrigation plays a vital role in crop production so, irrigation facility should be increased.

3. No suitable varieties of rice for high hill have developed and hence special attention should be given in that region.

4. High yielding and early varieties of maize are in great demand in the whole region, the proper attention should be given to develop such varieties.

5. Germination problem of the seeds of paddy as well as maize have been seen in different parts of the region that's why proper attention should be given before supplying the seeds.

Program of Paddy (1983-84) *

Western Development Region

Production in MT
Area in hectares

Sl. No.	Districts	Special Program Area	Special Program Production	Pocket Program Area	Pocket Program Production	General Program Area	General Program Production
01	Nawalparasi	310	1308	4902	20796.2	16050	43242
02	Rupandehi	2100	7440	6000	23205	28050	65466
03	Kapilvastu	3306	9740	6020	14200	4035	8581
04	Palpa	-	-	1202	3400	504	1940
05	Arghakhanchi	-	-	-	-	270	500
06	Gulmi	-	-	51.5	145	355	710
07	Baglung	-	-	505	1423	430	757
08	Parbat	-	-	50	25	700	1459.5
09	Myagdi					265.02	535.3
10	Mustang	-	-	-	-	-	-
11	Syangja	27.5	73	2027	5319	2603	4542
12	Kaski	1117	4182.25	2222.5	6244	762	1222
13	Tanahun	230	800	1050	2750	420	750
14	Lamjung	650	-	521	1049.5	317.5	655.4
15	Gorkha	218	3718.87	360	591.3	869.5	887
16	Manang	-	-	-	-	0	-
	Total :	7958.5	27162.12	24911	79148	55622.02	131247.2

* - Including Project's Program also.

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Program of Maize (1984-'85)

Western Development Region

Production in MT
Area in hectares

Sl. No.	Districts	Special Program Area	Special Program Production	Pocket Program Area	Pocket Program Production	General Program Area	General Program Production
01	Nawalparasi	1503	3348	253	780.76	3760	12867.65
02	Rupandehi	128	384	395	1205	2536.5	3999.5
03	Kapilvastu	103	300	250	616.5	78	139
04	Palpa	-	-	210	173	4451	6871
05	Arghakhanchi	-	-	7	14.8	553	1420
06	Gulmi	87	257	41	53	1482	2800
07	Baglung	-	-	30	50.5	2115	4100
08	Parbat	-	-	30	65.9	2500	4501.2
09	Myagdi	-	-	12.7	60	1322.6	2023.6
10	Mustang	-	-	-	-	-	-
11	Syangja	91	249	73	185.2	2974	6840
12	Kaski	121.95	382	12	23.5	2535	3223.8

Contd.../...

13	Tanahun	80	124	75	95	2800	5230
14	Lamjung	42.85	221.5	35.75	92.7	1988.5	1802
15	Gorkha	89	201	143.5	3821	2840	6338.8
16	Manang	-	-	-	-	70	56.4

Including Project's Program also.

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Area Under Improved Rice and Maize Crop 1984-'85

Area in hectares

S.No.	Districts	Rice	Maize	Remarks
01.	Nawalparasi	21262	5516	
02.	Rupandehi	10950	3059.5	
03	Kapilvastu	13361	431	
04	Palpp	1706	4661	
05	Gulmi	406.5	1610	
06	Arghakhanchi	270	560	
07	Baglung	935	2145	
08	Parbat	750	2530	
09	Myagdi	256.02	1335.3	
10	Mustang	-	-	
11	Syangja	4657.5	3138	
12	Kaski	4101.5	2668.95	
13	Tanahun	1700	2955	
14	Lamjung	1488.5	2067.1	
15	Gorkha	1447.5	3072.5	
16	Manang	-	70	
	Regional Total :	63291.52	35819.35	

SOURCE: Regional Progress Report 1984-1985
Western Development Region, Pokhara

Regional Report on Summer Crops
Mid-West Development Region

S.P. Adhikari*

INTRODUCTION

This mid-west development region comprises of 15 districts of varying agro-climatic as well as socio-economic condition. Out of these 15 districts, Banke and Bardia are tarai districts and Dang and Surkhet are valleys, rest 11 districts are high hills and mountainous. Comparatively this region is poor in agricultural production since the farmers are deprived of many resources for agricultural production. Even though extension personnels are trying their best to meet the national target of food production. There are two integrated programs namely RIRDP which covers 5 districts of Rapti Zone and K-BIRD covers Surkhet, Dailekh and Jumla districts. Both of these projects have contributed considerable efforts in increasing agricultural production. Banke is the only district of the region where Training and Visit System is launched.

In hilly districts of the region, maize is the important crop whereas Banke, Bardia, Surkhet and Dang, paddy is main summer crop. Farmers have to face a great problem due to irregular rainfall. Some times maize is destroyed by excessive rainfall whereas in some years production was very low due to drought. Paddy production has been too low in many districts in past few years due to drought or late and low rainfall. This is because there are not large irrigation projects in the region. Other crops also become victims of such uncertain climatic conditions. Besides paddy and maize, people of this region grow finger-millet (Kodo) but very less effort has been put for the improvement of this crop. Crop wise description of summer crops are as follows:

MAIZE

More or less, maize is grown in all 15 districts of the region. The important maize growing districts based on total acreage are Dang, Banke, Bardia, Dailekh and Surkhet. Maize is one of the most important cereal crops of the region, especially in the mid-hilly region. Out of the 5 different regions MWDR stands in 4th position (16.36 % of total area in 1982/83) so far as the area

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and production of maize is concerned. In 1983/84, the area covered under improved maize was 21404 ha. and production was 37984 MT. The target for maize cultivation and production for Fiscal Year 1984/85 is 19400 ha. and 38080 MT respectively.

Varieties popular in tarai are Rampur Composite, Rampur Pahenlo and Hetauda Composite. Arun- and Khumal Pahenlo is famous in hilly areas. Local White and Local Yellow are major local varieties grown.

Mostly maize is cultivated as a summer season crop. Very less is done in winter maize in this region. One of the reasons for this, especially in tarai, is lack of irrigation facility and problem from animals which are set free for grazing. In hilly areas also, farmers do not grow winter maize. Last year maize production was expected to go down since there was heavy rainfall during growing season, especially in tarai. The total area under maize cultivation in 1981/1982 was 78000 with a production of 119000 MT. on an average yield of 1.533 MT/ha. The area under improved maize at that time was only 16554 ha which is only 21% of total maize area in 1981/82. So we have still to do a lot in order to expand the improved maize varieties. The productivity of maize in different districts of the region calculated on the basis of 5 years average (1975/76 - 1979/80) of production of maize clearly indicates the task yet to be achieved. Though there has been some increase in average production after cash program was launched. The main handicaps are lack of irrigation facilities and timely and locally availability of fertilizers and seeds to the farmers. In 1983/84 this crop was damaged by land slide in some of the districts. In 1983/84 the total area under special, pocket and general program of maize was 345, 1886 and 19255 ha respectively. The area and production under improved maize is given in Table 6.

DISEASE AND INSECT PROBLEM IN MAIZE

S.No.	District	Problem
1.	Rukum	Borer, Army Worm, Stalk Rot
2.	Rolpa	Stalk Rot, Borer, Termites, Army Worm
3.	Bardia	Stalk Rot, Lodging, Borer
4.	Kalikot	Borer
5.	Banke	Stalk Rot, Root Rot

6.	Dailekh	Borer, Downy Mildew
7.	Jajarkot	Stalk Rot.

Insect, Pest and Disease problem in rest of the districts was not severe.

MINIKITS

The performance of minikits distributed from NMDP was quite satisfactory. We have not yet been able to get 100 % response of the minikit cards from the farmers. The minikit impact has been quite good and farmers demand more seeds of those varieties in coming season. Many high hill districts of this region have not yet received the benefit of such packets, so we would like to request NMDP to provide few such minikits, if possible, to such districts like Dolpa, Humla, Jumla, Kalikot and Mugu. This will be an effective tool to popularize the improved varieties in those areas.

PADDY

Paddy is most important cereal crop of the region and occupies largest area in cultivation. On national basis, it stands 4th in acreage. In 1981/82, the total area under paddy was 115000 ha and production was 224 MT with a productivity of 1.94 MT/ha. The area under improved paddy in the same year was 31577 ha. In 1983/84, the area under improved was 34190 with a production of 103976 MT. In the running Fiscal Year 1984/85, the target is set to cover 46310 ha area under improved paddy with a total production target of 125791 MT (i.e. 2.72 MT/ha average productivity of special, pocket and general programs). Out of the total target set for 1984/85 i.e. 46310 ha under improved paddy 12760, 11650, 21900 ha with production of 45681, 33435 and 46506 MT respectively.

The main paddy growing districts of the region are Bardia, Banke, Dang and Surkhet. These 4 districts may be called as the granary of the region. Karnali Zone is backward in cereal production. Many hilly districts of the region have to depend on outside areas for food supply. The district-wise area and production is given in Table 5.

In 1983/84, grow more paddy special program was launched in Banke and Dang districts and this program increased the production paddy in both districts. From this fiscal year, we have started a regional level cropping systems program in 2000 ha (Banke 1000 ha and Dang 1000 ha).

In Rapti Zone PPVT program was started few years before and its performance is satisfactory. It has helped a lot in making new varieties popular among the farmers. Same is the case with production program also.

Minikits sent from NRDP are doing well. We request NRDP to supply more minikit sets.

DISEASE AND INSECT PROBLEM IN PADDY

S.No.	Districts	Disease	Insect
1.	Dailekh	BLB, Blast of Paddy	Gandhi bug
2.	Rukum	Brown Spot, BLB	Borer, Rice Hispa
3.	Salyan	Root Rot, BLB, Brown Spot	Borer
4.	Surkhet	Brown Spot, Blast	Grass Hopper, Gandhi bug
5.	Jajarkot	BLB, Blast, Brown Spot	" " ", Borer
6.	Pyuthan	Blast, False Smut	Stem Borer
7.	Kalikot	Blast, BLB	Stem Borer
8.	Bardia	BLB, Zinc deficiency	Hispa, Stem Borer
9.	Rolpa	Blast, Brown Spot	Hispa, Leaf Roller, Gandhi bug
10.	Banke	False Smut, BLB	Army Worm, Borer, Gandhi bug.

No significant attack of insect, pest and disease is reported from Karnali Zone.

MILLETS

Mainly finger millet is grown in hilly areas of this region. Major finger-millet growing districts are Salyan, Pyuthan, Rukum, Rolpa, Jajarkot, Humla, Kalikot, Dolpa and Jumla. After maize this crop has been the important cereal crop of hills. No improved seed is supplied to farmers, i.e. to tell frankly this is most neglected crop. So we would like to request concerned authorizes to extend research activities in this very crop and if possible to borrow suitable fingermillet varieties from neighbouring countries.

Jowar and Bajra are also neglected crops. Not any variety of these two crops are so far distributed in the region.

Buck wheat also occupies some area in our region and is used to prepare breads. Almost negligible work seems to have been done in this crop also.

In a nut shell we would like to focus the attention of all concerned personnel in improvement of the local existing varieties of the above mentined millets.

Table 1: Target and Achievement Under Millet in Different Years

S.N.	Districts		1983/84	1984/85	S.N.	Districts		1983/84	1984/85
1.	Dang	A.	640	100	9.	Banke	A.	-	-
		P.	800	123			P.	-	-
2.	Salyan	A.	1140	1250	10.	Bardia	A.	-	-
		P.	1425	1537			P.	-	-
3.	Pyuthan	A.	940	200	11.	Jajarkot	A.	1626	600
		P.	1175	246			P.	2032	738
4.	Rukum	A.	1040	150	12.	Humla	A.	500	500
		P.	1300	184			P.	625	625
5.	Rolpa	A.	940	200	13.	Mugu	A.	500	500
		P.	1175	246			P.	625	625
6.	Surkhet	A.	700	400	14.	Kalikot	A.	1100	1100
		P.	875	492			P.	1375	1375
7.	Dailekh	A.	150	100	15.	Dolpa	A.	400	400
		P.	187	123			P.	500	500
8.	Jumla	A.	-	100					
		P.	-	123					
							A.	9676	5600
							P.	12094	6937

EXTENSION ACTIVITIES IN SUMMER CROPS (MAIZE + PADDY)

Extension activities are playing an important role in the diffusion of new technology to the farmers. Result demonstration are conducted in the farmers field. On training side sub-centre leader farmer training, farmers meeting, week long district level leader farmer training are organized by ADO Office. Pre-Production Verification Trials are already carried out in Rapti Zone districts

which has now come up in block production phase.

The details of regional extension activities carried out in summer crops is presented in the following table.

S.No.	Extension Activity	1983/84	1984/85
1.	Result Demonstration	688	514
2.	Agri. Fair Exhibition	16	22
3.	Farmers Tour	30	48
4.	Grow More Food Competition	18	17
5.	Production Demonstration	329	229
6.	Method Demonstration	250	215
7.	Farmer's Day	6	9
8.	Regional Farmer's Meeting	-	1
9.	Minikit Demonstration	482	400

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Table 2: Average Production of Maize (1983 / 1984) MT. / ha.

S.No.	District	RD	MD	Crop Cutting	PD	PPVT	FFT
1.	Jajarkot	2.17	-	-	-	-	-
2.	Dailekh	2.0	-	-	2.6	-	-
3.	Banke	-	1.8	-	-	-	-
4.	Kalikot	2.5	-	-	-	-	-
5.	Pyuthan	3.35	-	-	-	-	-
6.	Bardia	1.4	-	-	-	-	-
7.	Rolpa	2.8	-	-	2.5	4.21	-
8.	Salyan	3.26	3.0	-	-	-	-
9.	Jumla	-	-	1.47	-	-	-

Table 3: Average Production of Paddy (1983 / 1984) MT. / ha

S.No.	District	RD	MD	Crop Cutting	PD	PPVT	FFT
1.	Jajarkot	2.85	-	-	-	-	-
2.	Dailekh	2.5	-	-	-	-	-
3.	Banke	3.2	2.2	-	3.5	-	2.75
4.	Kalikot	3.0	-	-	-	-	-
5.	Pyuthan	4.15	-	-	-	-	-
6.	Bardia	3.01	3.5	-	-	-	-
7.	Rolpa	3.5	-	-	3.75	3.97	-
8.	Salyan	4.42	3.6	-	-	-	-
9.	Jumla	-	-	2.14	-	-	-

Note:

RD = Result Demonstration

MD = Minikit Demonstration

PD = Production Demonstration

PPVT = Pre-Production Verification Trial

FFT = Farmer's Field Trial.

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Table 4: Varieties Preferred

S.No.	District	Maize	Paddy
1.	Jajarkot	Kakani Yellow	Janaki, Masuli
2.	Salyan	Kakani Yellow, Khumal Yellow	Kanchan, Janaki
3.	Dailekh	Rampur Yellow, Khumal Yellow, Hetauda Composite	Laxmi, Janaki
4.	Banke	Rampur Composite	Saket-4, Janaki, Sabitri
5.	Pyuthan	Sarlahi Seto, Khumal Yellow, Rampur Yellow, Arun	K-39, Sabitri, Janaki, CH-45, Taichung

Contd.../...

Table 4 (Continued)

6.	Bardia	Arun, Rampur Composite	IR-8, Sabitri, Laxmi, Janaki, Durga
7.	Rolpa	Rampur Composite, Khumal Yellow, Sarlahi Seto	Himali, Kanchan, K-39
8.	Rukum	Arun	Kanchan, Janaki, Masuli
9.	Surkhet	Sarlahi Seto (best preferred)	Masuli, Janaki, Durga, Sabitri

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Table 5: Target and Achievement Under Improved Paddy and Maize in Different Years

S.No.	District		1983/84	'84/85	S.No.	District		1983/84	1984/85
1.	Dang	A.	8400	8980	9.	Banke	A.	8010	11740
		P.	21954	25289			P.	26136	32339
2.	Salyan	A.	850	825	10.	Bardia	A.	9440	13497
		P.	19024	18087			P.	33607	38724
3.	Pyuthan	A.	450	625	11.	Jajarkot	A.	750	971
		P.	1068	1548			P.	1675	2274
4.	Rukum	A.	400	970	12.	Jumla	A.	60	60
		P.	1520	2819			P.	128	127
5.	Rolpa	A.	225	200	13.	Mugu	A.	30	40
		P.	481	439			P.	64	91
6.	Surkhet	A.	3200	5020	14.	Kalikot	A.	25	50
		P.	8692	12940			P.	53.5	106
7.	Dailekh	A.	850	1850	15.	Dolpa	A.	-	-
		P.	2414	4013			P.	-	-
8.	Jumla	A.	1500	1500					
		P.	4260	3195					

Table 6: Maize

S.No.	District		1983/84	'84/85	S.No.	District		1983/84	1984/85
1.	Dang	A.	5448	1725	9.	Banke	A.	3846	4550
		P.	8557	3365			P.	7068	8900
2.	Salyan	A.	302	150	10.	Bardia	A.	3942	4135
		P.	471	300			P.	7765	8345
3.	Pyuthan	A.	1696	2115	11.	Jajarkot	A.	250	625
		P.	2616	4115			P.	505	1223
4.	Rukum	A.	488	195	12.	Humla	A.	65	200
		P.	776	385			P.	123	380
5.	Rolpa	A.	820	365	13.	Mugu	A.	65	75
		P.	1295	733			P.	126	148
6.	Surkhet	A.	2600	2882	14.	Kalikot	A.	105	105
		P.	5057	5626			P.	200	199
7.	Dailekh	A.	1399	1900	15.	Dolpa	A.	110	110
		P.	2676	3634			P.	212	213
8.	Jumla	A.	268	264					
		P.	537	509					
					Total:-	Area		21404	19396
						Production		37984	37975

CONSTRAINTS

The constraints mainly faced in maize and paddy are as follows:

1. Poor management of pest harvest losses of cereals
2. Scarcity of maize and paddy seeds
3. Timely unavailability and unreliability of seeds demanded by the farmers
4. Poor research program being carried out in millets (especially fingermillet)
5. Less irrigation facility
6. Timely unavailability of fertilizers.

SUMMARY

This region is backward in respect of different facilities needed for proper cultivation of crops, nevertheless, we have been putting our best efforts to make every production program successful. We have to continue our strong efforts from extension side. We would like to request different national crop programs to evolve varieties suitable to the high hill regions of the country. Extension personnel should be able to take all the prevailing technologies available to the farmers. Farmers interest is increasing towards pulses rather than cereals. So we request concerned authorities for exploring the possibilities of borrowing suitable varieties developed else where to increase production. We have already mentioned about the poor research so far carried out in millets.

This year reports of poor germination of paddy in Banke and Bardia districts were obtained, particularly in Janaki variety. If such thing happens again it will make farmers reluctant to use new improved varieties.

We have been launching special and pocket program of different cereal crops, summer as well as winter. Reports show that the total amount of fertilizers and other inputs which were to be utilized in such areas are hardly used. Due to this reason the expected target of productivity has not yet been achieved. Same was the case with crash program launched few years before.

At last, we wish a bright agricultural future hoping that this valuable gathering will consider technological aspects of increasing production of summer cereal crops in different parts of the country after analyzing the different problems realized before and thus help in agricultural production.

Regional Report on Summer Crops
Far-Western Development Region, Dipayal

R.L.P. Dhami*

INTRODUCTION

Before dealing with the report of the Far Western Development Region on summer crops, it is of utmost concern to this August gathering to have a general view of the existing situations of the region in brief. The regional planning approach became part of the policy formulation of the Fourth Five Year Plan. The plan document simply recognized the problem of the disparity of economic development in different regions of Nepal. To achieve the goals set in the Fourth Five Year Plan through regional planning, the regional development centre concept came into being in 1972 (2029 B.S.) in order to bring dynamic attention to different geographical areas of Nepal in administration, investment policy and fulfillment of the basic needs of the people. As a result, the four development regions (Eastern, Central, Western and Far-Western) were created.

Prior to the creation of the Fifth Development Region, it was under the Far-Western Development Region (Surkhet) which was covering five zones (Rapti, Bheri, Karnali, Seti and Mahakali). Seti and Mahakali zones of the then Far Western Development Region (now Mid-Western Development Region) were too far from the Surkhet Development Centre and the capital, so it was not possible to pay due attention for the speedy development of these two zones. The expedite more development activities for the socio-economic uplift of these two zones, a separate region as a fifth region in the name of Far-Western Development Region(Dipayal) was created in 1980 (2037 B.S.)

This region covers nine districts, two in Tarai (Kailali and Kanchanpur), four in the hills (Doti, Achham, Baitadi and Dadeldhura) and three in the high hills (Bajura, Bajhang and Darchula). This region lies in between 28°30' to north latitude and 80° to 81°30' east longitude. The altitude varies from 176 to 7134 m.a.s.l. This region covers an area of 19,248 sq.km which is about 13.0% of the total area of the count (147,181 sq.km) with a population of 1,311,833 (1981 census) which is about 9% of the total population of the country.

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* Regional Director.

Population density of this region is on an average 70 persons per sq.m.. and annual population growth rate is 2.93%. It is the least developed region in the country. The economy of this region is handicapped by its very difficult geo-physical conditions, difficult internal communications, limited resources and lack of skilled manpower.

Farming is the main occupation of the people of this region. The number of agricultural family households of this development region is 197,552. This region covers only 13% of the total cultivated area of the country. The major summer crops of the region are rice, maize, millet, pulses, groundnut, potato etc.

The estimated total food production of this region in the F.Y. 2040-2041 B.S. is 312,000 metric ton which comes about 7.27% of the total food production of the country. Out of 312,000 metric ton, summer food production is 241,000 metric ton and winter food production is 71,000 metric ton. The food production in F.Y. 2040-2041 has increased by 12.23% in comparison to F.Y. 2039-2040 (278,000 metric ton). Food out look of this region is given in Table No.1.

Special projects such as Mahakali Integrated Rural Development Project, (Darchula, Baitadi and Dadeldhura) Mahakali Irrigation Project (Kanchanpur), Khutia Irrigation Project (Kailali), Mohana Irrigation Project (Kailali and Kanchanpur) etc. are also helping to develop infrastructure of development in this region.

RICE

Rice is the main summer crop of this region. The improved varieties of rice being grown in this region are Masuli, Laxmi, Durga, Janaki, Sabitri, IR-8, IR-20, IR-22, Taichung-176, Chinan-242, Himali and Kanchan. Maximum hectarage of the tarai districts is covered by the Masuli variety. On the plateau of hill districts IR-8, Laxmi, Durga, Himali and Chinan-242 are quite popular amongst the farmers. Upland paddy (Ghaiya) is also quite popular in the hilly area. Tarai districts (Kailali and Kanchanpur) are surplus in rice production whereas the remaining districts are unable to meet the food requirement of the people. In order to know the response of the newly evolved variety of rice N.R.D.P. has launched the minikit program in collaboration with district agricultural office. Darchula and Baitadi have reported that

Himali and Chinan-242 varieties have given the maximum yield (3.5 mt per ha). The area and production under rice in different districts are given in the Table No.2.

Besides those improved varieties there are some local varieties which are quite popular amongst farmers of hilly area of this region, i.e. Thapachinia, Basmati, Jhani and Rajnati. The target and achievement of rice in the F.Y. 2040/2041 and the target in the F.Y. 2041-2042 are given in Table 3 (I & II).

Special paddy production program was launched in the Kanchanpur district in the F.Y. 2039-2040 by the Ministry of Agriculture and the production was increased by 35%.

On the basis of the experience and satisfactory achievement resulted from the last year by paddy special program, Ministry of Agriculture has started this program in Kailali district also. This program emphasizes on intensive cultivation supported by timely input management. The ultimate goal of this program is to maximize the production per unit area. The target and achievement of this region is given in Table 4.

From the winter season of this F.Y. 2041-2042, cropping systems program has been introduced in Kailali and Kanchanpur districts of this region covering 1000 hectares each.

MAIZE

This is the second main food grain crop grown in all the nine districts of this region. The popular maize varieties being grown in this region are Hetauda Composite, Khumal Yellow, Kakani Yellow, Rampur Yellow, Rampur Composite and Sarlahi Seto. The popular variety in the high hill is Kakani Yellow, in the mid hill is Khumal Yellow and in tarai are Rapur Yellow and Hetauda Composite. Ganga-2, Ganga-4 and Hi-starch (white maize) are quite popular in Darchula whereas Murali the local variety is also popular in the hilly areas of this region. As a result of minikit program of N.M.D.P., three crops (summer, winter and spring) of maize in a year can be grown in the tarai area of this region. Spring maize is also getting popularity in Kailali. The area and production under maize in different districts of the region are given in Table 5.

The target and achievement of the maize in the F.Y. 2040/2041 and the target in the F.Y. 2041-2042 are given in Table 6 (I and II).

MILLET

This is the major food crop in the hilly area of this region. This crop can be grown under dry to low fertility conditions of soil. Comparatively not much disease and pest attack has been noticed. The area and production under millet in this region are given in Table 7.

PULSES (SUMMER)

The main summer pulses crops of this region are soybean, green gram, black gram and horse gram.

POTATO

During summer season potato is mostly grown in the high hilly area of Darchula, Doti, Baitadi, Bajhang, Bajura and Achham districts of this region. In those food deficit areas, people use it as a staple food.

COTTON

Kem Cot species-37 variety of cotton has been introduced in the farm of Tikapur Bikas Samiti of Kailali. About 6 ha of land was covered and about 15 quintal per ha yield was obtained, its maximum expected yield is 50 quintal per ha though red cotton bug, cotton boll weevil, cotton jassids, etc were noticed as major insect pests. Cotton can be successfully grown in the plain areas of this region.

EXTENSION ACTIVITIES

To popularize the improved varieties of rice, maize and other summer crops, district agricultural development offices organize various extension activities such as result and production demonstration, grow more crop competition, minikit program, training program, field tour and field days etc. as a result the farmers are getting convinced of the improved technology of farming and are adopting them gradually.

This year the loss caused by floods due to heavy rain was too heavy in Kailali district, but it did not affect the production of summer crops. Similar natural calamities like hailstone, flood, drought, earthquake occur very often and affect the production of the region.

PROBLEMS AND SUGGESTIONS

1. For all round development of the region, infrastructure of development is a must, especially in Seti Zone because there is no development project or any other program as in the case of Mahakali Zone.

2. Timely input availability is a constraint in this region, so due attention should be paid by the concerned agency for the timely supply of inputs especially seed and fertilizer.

3. The quality of seed supplied should be of high standard. Farmers are loosing their belief in improved seeds because of impurity and low germination percentage. The agency concerned for the distribution of seed should be alert and no seed should be distributed without testing the germination of seed.

4. There is only one horticulture farm (Satabanj in Baitadi) in the region which can not meet the ever increasing demands of the farmers of tarai and hill region, so both in tarai and hill horticulture farm should be established.

5. There is a great potentiality of cotton, jute, tobacco and sugarcane in the tarai districts of the region. Therefore, these programs should also be started.

6. One Agriculture Research Station/Farm should be established in the tarai area of this region as there is no any research station/farm in this region.

Table 1: Food Out look of Far Western Development Region

Food Outlook

Physical developmental area	Summer food prod. (Paddy+Maize+Millet)		Prodn. %age in comparison to the last yr.	Winter food Production		Prod. %age in comparison to the last year	Total food prodn.		Production percentage in comparison to the last FY
	2039/40	040/41		039/40	040/41		039/40	040/41	
High hill	18010	19110	106.11	9100	9890	100.68	27110	29000	106.97
Mid hill	48750	46800	96.00	31170	31340	100.55	79920	78140	97.77
Terai	131300	175420	133.60	39620	29330	74.03	170920	204750	119.79
Regional Prodn.	198060	241330	121.85	79890	70560	88.32	277950	311390	112.21
Nepal	2671930	3633000	135.97	681250	655970	96.29	3353180	4288970	127.91

Source: Food Outlook (2041-2042), Kartik
Department of Food and Agricultural Marketing Services.

Table 2: Area and Production of Paddy in FWDR

Fiscal Year	Units	Bajhang	Bajura	Doti	Accham	Kailali	Kanchanpur	Dadeldhura	Baitadi	Darchula
1974-75	Area(ha)	2700	3100	4900	2700	41800	21200	2800	3300	900
	Prod(Mt)	5400	6200	11515	6075	85690	39008	6440	7920	1809
1975-76	Area(ha)	2700	3100	4900	2700	44800	23151	2800	3300	900
	Prod(mt)	5830	6450	12470	3430	94650	42760	7060	8480	1900
1976-77	Area(ha)	2700	3100	4998	2700	44800	24890	2000	3300	900
	Prod(mt)	5830	6450	12690	3600	75720	32666	5540	8400	1900
1977-78	Area(ha)	2700	3100	4900	2590	46670	24900	1350	3300	1500
	Prod(mt)	5430	5800	12600	3750	81680	37230	2970	6930	3080
1978-79	Area(ha)	2700	3100	5000	2450	46670	21200	1200	3100	1400
	Prod(mt)	5400	6510	12240	3630	81680	42330	2850	6510	2800
1979-80	Area(ha)	2700	3100	5000	2450	42010	24900	2110	3100	1380
	Prod(mt)	4590	5210	8570	2540	32670	16930	2710	3910	2380
1980-81	Area(ha)	2700	1810	5000	2600	49260	24950	2000	3300	1460
	Prod(mt)	4510	3260	10400	3600	36700	43660	3600	6570	2190
1981-82	Area(ha)	3100	1810	6920	2690	40770	25000	2000	3300	1840
	Prod(mt)	5780	3200	13150	3770	73700	55000	3450	6600	2300
1982-83	Area(ha)	2940	1470	6020	1930	42800	27400	5380	3300	1840
	Prod(mt)	4910	3130	8650	2700	58000	44240	8630	6270	2210
1983-84	Area(ha)	2940	1470	6920	1930	40420	35070	5390	3500	1840
	Prod(mt)	4940	2650	10380	2890	75600	77150	5760	5940	2580

Source: Department of Food & Agri. Marketing Services,
Agri. Stat. Division.

Table 3(i): Target and Achievement of Improved Rice FY 040-041

Area in ha
Prod in MT

Districts / Region	Special Programme				Pocket Programme				General Programme			
	Area		Production		Area		Production		Area		Production	
	Target	A	T	A	T	A	T	A	T	A	T	A
Kailali	2500	3007	8750	13232	5000	5005	14214	15624	3500	3659	7400	10794
Kanchanpur	6300	6312	22050	22092	4835	4865	13781	13816.6	–	–	–	–
Doti	–	–	–	–	500	500	1420	1420	2500	2500	5350	5350
Dadeldhura	–	–	–	–	1000	1000	2800	2700	400	535	850	880
Achham	–	–	–	–	–	–	–	–	300	305	642	643
Baitadi	–	–	–	–	1000	1025	2900	2908	353	356	7555	756
Darchula	–	–	–	–	700	700	1960	1960	200	200	420	420
Bajhang	–	–	–	–	–	–	–	–	200	200	420	420
Bajura	–	–	–	–	–	–	–	–	1000	1000	2140	2140
Region	8800	9319	30800	35374	13095	13095	37019	38423.6	8453	8752	18083	21419

Table 3(ii): Target of Improved Rice in FY 041-042

Area in ha
Prod in MT

Districts / Region	Special Programme		Pocket Programme		General Programme	
	Area	Production	Area	Production	Area	Production
Achham	-	-	50	143.5	1000	2130
Doti	-	-	460	1320.2	2000	4260
Bajura	-	-	360	1033.2	1000	2130
Bajhang	-	-	30	86.1	1000	2130
Kanchanpur	4000	14320	4800	13876	4000	8520
Baitadi	-	-	1200	3444	1100	2343
Kailali	3000	10740	3000	8610	4000	8520
Darchula	-	-	-	-	1000	2130
Dadeldhura	-	-	1000	2870	1100	2343
Region	7000	25060	10900	31383	16200	34506

Table 4: Special Paddy Production Programme FY 2040-041

Districts	Area Covered ha			Prod activities MT			Prod loan Rs	Boring no.	P.set no.	Boring & P loan Rs	Seed distr. MT	Fert. distri-bution mt.	Ag. Tools Rs.	Insecticide distribution	
	S	P	G	S	P	G								Dust MT	Liquid lit
Kailali	3007	5005	3659	13202	15624	10794	214261.14	64	112	1053191.40	6.324	148.156	26567.47	1.512	103.4
Kanchanpur	6312	4865		22092	13816.6		291000	20	75	777000	0.66	94.370	9957.25	0.372	21.350
	9319	9870	3659	35374	29440.6	10794	505261.14	84	187	2830191.4	6.984	242.526	36524.7	1.884	124.75

P = Pumping set S = Special program

P = Pocket program G = General program

Table 5: Area and Production of Maize in FWDR

Fiscal Years	Units	Bajhang	Bajura	Doti	Achham	Kailali	Kanchanpur	Dadeldhura	Baitadi	Darchula
1974-75	Area(ha)	1000	800	4700	3200	10183	6000	3300	2350	1314
	Prodn(mt)	1630	1296	9165	6080	13583	8400	6270	5344	3102
1975-76	Area(ha)	1000	800	4700	3200	10130	6000	3300	2350	1310
	Prod(mt)	1550	1230	8250	6270	,8130	7500	4020	4810	2950
1976-77	Area(ha)	1000	800	4700	3200	11200	5650	3100	2350	1320
	Prod(mt)	1630	1290	8250	6300	15500	8820	4495	5300	3100
1977-78	Area(ha)	990	800	4600	3000	14420	4130	3150	2650	1920
	Prod(mt)	1540	1220	7700	5310	15890	8260	4720	4430	2610
1978-79	Area(ha)	1000	800	4500	3100	11150	6000	3200	2700	1840
	Prod(mt)	1550	1400	7530	5470	16730	6200	4810	4510	3200
1979-80	Area(ha)	1000	800	4500	3100	11150	4130	3200	2700	1840
	Prod(mt)	1550	1400	7530	4920	16730	5890	5290	4510	3200
1980-81	Area(ha)	1000	700	4270	2850	11420	6370	3100	2900	2570
	Prod(mt)	1460	1260	6830	4390	17470	9750	4460	4120	3620
1981-82	Area(ha)	1000	780	4200	2850	10230	4950	2480	2900	2570
	Prod(mt)	1600	1250	6720	3800	14320	6440	3540	3770	4110
1982-83	Area(ha)	900	780	4200	2850	11500	8610	2540	2900	2570
	Prod(mt)	1260	870	6720	3420	13600	12720	3630	2830	3490
1983/84	Area(ha)	900	780	4200	2850	1155	4990	2380	2900	2570
	Prod(mt)	1520	1130	6050	3420	14620	6560	3330	3530	4110

Source: Department of Food and Agri. Marketing Services, Agri. Stat. Division.

Table 6(i) Target and Achievement of Improved maize (FY 040-041)

Area in ha
Prod in MT

Districts Region	Special Programme				Pocket Programme				General Programme			
	Area		Production		Area		Production		Area		Production	
	T	A	T	A	T	A	T	A	T	A	T	A
Kailali	150	266.5	1350	2303.5	700	703.5	1540	1745.7	5500	5593	10450	10626.7
Doti	13	13	162	162	200	200	440	440	50	50	95	95
Achham	-	-	-	-	600	601	1320	1321	600	605	1140	1142
Bajhang	25	25	225	225	100	100	220	220	500	500	950	950
Bajura	20	20	100	100	395	395	869	869.	355	355	674.5	674.5
Darchula	-	-	-	-	737	737	1621.4	1621.4	215	215	408.5	408.5
Baitadi	-	-	-	-	700	700	1540	1540	800	807	1520	1520
Dadeldhura	-	-	-	-	500	500.	1100	1100.	180	180	342.	342
Kanchanpur	35	153	255	330	5055	5109.5	11121	11240.0	3154	3160	5992.6	6004
Region	290	482.5	2172	3304.5	9987	9136	19771.4	20098	11354	11463	21602.6	21762.7

T = Target, A = Achievement

Table 6(ii): Target of Improved Maize in FY 2041-042

Districts / Region	Special Programme		Pocket Programme		General Programme	
	Area	Production	Area	Production	Area	Production
Achham	15	45	25	57.5	100	190
Doti	25	75	35	80.5	100	190
Bajura	15	45	10	23.0	100	190
Bajhang	15	45	25	57.5	100	190
Kanchanpur	340	150	325	747.5	2400	4560
Baitadi	200	840	175	402.5	1200	2280
Kailali	230	690	255	586.5	2000	3800
Darchula	-	-	50	115	400	760
Dadeldhura	105	315	75	172.5	400	760
Region	1025	2205	975	2242.5	6800	12920

Table 7: Area and Production of Millets in FWDR

Year	Units	Bajhang	Bajura	Doti	Achham	Kailali	Kanchanpur	Dadeldhura	Baitadi	Darchula
1974-75	Area(ha)	1020	1000	1350	850	1400	500	2300	850	625
	Prod(mt)	1264	1150	1640	1011	1210	500	2702	986	719
1975-76	Area(ha)	1030	1000	1350	850	1400	500	2300	830	620
	Prod(mt)	1260	1160	1640	1010	1220	510	2430	990	732
1976-77	Area(ha)	1020	1000	1350	850	1400	500	2000	830	620
	Prod(mt)	1260	1150	1640	1000	1220	570	2200	980	720
1977-78	Area(ha)	970	1000	1200	850	1400	500	1800	850	740
	Prod(mt)	1200	1140	1500	1080	1300	560	2160	1070	960
1978-79	Area(ha)	970	1000	1300	900	1400	500	1850	900	620
	Prod(mt)	1200	1250	1500	1060	1400	500	2220	1060	800
1979-80	Area(ha)	1000	970	1300	900	1400	500	1940	900	620
	Prod(mt)	1050	1070	1390	1000	1340	490	2300	1060	710
1980-81	Area(ha)	900	1300	1370	850	1390	500	2000	1000	600
	Prod(mt)	980	1170	1400	1000	1400	650	2200	1100	540
1981/82	Area(ha)	710	700	1270	850	1390	500	3000	1000	700
	Prod(mt)	640	630	1400	940	1553	640	3300	1100	630
1982/83	Area(ha)	1020	700	1350	850	1300	600	2870	1000	700
	Prod(mt)	920	630	1560	940	1300	600	2300	1100	540
1983-84	Area(ha)	1020	700	1400	850	1300	400	2530	1000	700
	Prod(mt)	920	630	1260	760	1170	320	2530	900	630

Source: Department of Food and Agri. Marketing Services, Agri. Stat. Division.

Report on Maize and Fingermillet Works at Pakhribas Agricultural Centre, 1984

M.P. Pandey*

1. INTRODUCTION

Pakhribas Agricultural Centre is an adaptive research and resource centre located in the mid hills of Dhankuta district, Eastern Nepal. The Centres work covers all important components of hill farming systems, livestock, forestry, and crops.

2. SUMMARY OF TRIAL WORK CARRIED OUT AT PAKHRIBAS AGRICULTURAL CENTRE

Maize

Four different trials (breeding and varietal) were carried out at high and mid altitude bari land of PAC, in cooperation with National Maize Development Program.

2.1 Unit Evaluation Trial on Manakamana-1 (High Altitude)

As previous years PAC, in close cooperation with NMDP has been carrying out breeding selection work for a high yielding white seeded maize variety for the high-hills. Since 1982 one generation has been grown at PAC in the summer and one at Rampur in winter.

This summer, two unit evaluation trials on selected units of 1982/1983 winter and 1983/1984 winter, with 46 and 91 units, respectively, were tested on bari land at 1750 m.a.s.l. Screening for cob rot was carried out in cooperation with the Plant Pathology Division, Khumaltar.

The best 7 units out of 46 units and 10 units out of 91 units were selected for winter planting (1984/85) at Rampur.

2.2 NMDP Maize Varietal Trial (High Altitude)

Twelve varieties of maize were tested on bari land at 1750 m.a.s.l. No significant differences were shown between the varieties under test. The top yielding varieties being Pioneer 6181, (3324 kg/ha), followed by

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Manakamana-2 (2962 kg/ha), Rampur-2 (2784 kg/ha), and lowest yielding Rampur-1 (2083 kg/ha), Hetauda Composite (current PAC recommended cultivar for mid altitude) yielded 2228 kg/ha.

Arun-2 matured fastest in 132 DAS (days after sowing), and Pioneer-6181 latest in 151 DAS, whereas Hetauda Composite in 146 DAS.

During field selection at silking stage Arun-4, Arun-1, Pioneer-6181 and Arun-2 looked most promising.

Lowest lodging was recorded in Arun varieties and Manakamana-1, highest being in Ganesh-2.

Farmer's variety looked more resistant to cob rot than other varieties under test.

Almost all the varieties were affected by leaf diseases but worst affected were Rampur Composite and Hetauda Composite.

CONCLUSION

Pioneer 6181 being a hybrid and latest maturing varieties will not be extended, whereas varieties like Manakamana-1, Rampur Composite and Hetauda - Composite (Check), with other promising varieties will be tested in FFTs.

2.3 NMDP Maize Varietal Trial (Mid Altitude)

Twelve varieties of maize were tested on South farm bari land at 1350 m.a.s.l.

The trial was found statistically highly significant at the 1% level of confidence.

The highest mean grain yield was produced by Pioneer 6181 (3616 kg/ha), followed by Arun-2 (3518 kg/ha), Rampur Composite (3056 kg/ha) and lowest by farmer's variety (1533 kg/ha) whereas Hetauda Composite yielded 2916 kg/ha.

Arun-2 and Arun-4, Arun-1 matured earliest almost in same duration (116 DAS), whereas Pioneer 6181, Rampur-1 matured latest in 128 DAS.

Farmer's variety was recorded tallest (304 cm) but Pioneer 6181, and Arun-4 shortest (199 cm).

Stalk and root rot caused lodging problems in all the varieties, worst being in farmer's variety (30%) and lowest in Pioneer 6181 (6%). Hetauda Composite and Rampur Composite showed (13%) lodging. Only 1 - 3% of the plants in all varieties suffered from cob rot but Pioneer 6181 and Rampur-2 were observed free from the infection.

Twenty percent of the plants in case of Rampur-1 were found with bare tips but only 1% in farmer's variety.

Leaf diseases were observed in all the varieties, maximum being in farmer's local and minimum in Pioneer 6181.

Arun-2, Pioneer 6181, Rampur Composite looked promising during field selection.

Conclusion

Although Pioneer 6181 is one of the promising varieties in the test, it can only be promoted in FFTs, if an assurance for the long term regular supply of seeds and other inputs in future is planned. Hetauda Composite, Rampur Composite with other varieties will be tested in FFTs.

2.4 Varietal Trial on Maize : High Altitude (NMDP FFT Varietal Set)

This trial with five varieties, was tested on PAC North Farm bari and land, at 1750 m.a.s.l.

The differences between the yields of the varieties was found to be non-significant. But highest yielder was Manakamana-2 (2550 kg/ha) followed by Hetauda Composite (2225 kg/ha), Makalu-2 (2172 kg/ha) and Manakamana-1 (2142 kg/ha).

No remarkable difference in the maturity duration was found, since all the varieties matured within 144-146 DAS.

Manakamana-1 and Makalu-2 were found more resistant to lodging than Hetauda Composite and Manakamana-2.

Cobs with bare tips were recorded minimum (6%) in Manakamana-1 but maximum (12%) in rest of the other three varieties.

Leaf diseases had been observed in all varieties. Makalu-2 looked most promising during field selection at 50% silking stage.

Conclusion

In our target areas, farmers express a strong preference for white seeded varieties. Manakamana-1 is white seeded, and has given highest yields in FFTs in farmer fields. It will be tested in future years with and without fertilizer and in comparison with Hetauda Composite (PAC recommended variety for mid-altitude) + Makalu-2 (PAC recommended variety for high altitude).

2.5 Method of Planting Trial on Fingermillet (High Altitude)

This trial was carried out on Okhale-1 (recommended var), relay cropped with short statured maize variety (Arun-1) on bari land at 1750 m.a.s.l.

No significant difference in the mean yield of the method was observed. Millet grain yield by line sowing was 1033 kg/ha, followed by Broadcasting (1002 kg/ha), and Transplanting (994 kg/ha), but total production of maize + millet was found highest by transplanting method (3151 kg/ha) following by line sowing (2875 kg/ha) and Broadcasting (2831 kg/ha).

Conclusion

This trial will need to be repeated once at the centre, before conclusions can be drawn.

2.6 Initial Evaluation Trial on Fingermillet (Mid Altitude)

Sixteen varieties of fingermillet were tested on bari land as a sole crop at 1750 m.a.s.l.

Okhale-1 yielded (3485 kg/ha) significantly (1% level) better than all other varieties under test except PAC-Hill (Mudke type) which yielded 3121 kg/ha.

These top yielding varieties matured last in 175 and 179 DAS, respectively, NE-1305-46 a fifth ranking (2700 kg/ha) variety in yield, was earliest among all which matured in 128 DAS.

Shattering problem was observed to some extent in all varieties, maximum being in NE-189 and NE-6401-21(7%), and minimum in PAO-Hill (1%). Okhale-1 and NE-1305-46 showed 4 and 3% shattering respectively.

Lodging was observed in all the varieties, maximum being in NE-1102-12, NE-86, NE-1305-46 and NE-2101-21 all at 4 scale (1-5 scale), minimum being in PAC-Hill and NE-1304-1 both at 2 scale (1-5 scale).

No remarkable disease was observed in the trial.

During field selection before flowering. NE-1305-46 looked most promising.

Maximum straw yield (field weight, was produced by NE-1102-12 (31367 kg/ha), followed by NE-1304-1 (28873 kg/ha), Okhale-1(265333 kg/ha), PAC-Hill (23053 kg/ha) and NE-1305-46 produced 17200 kg/ha.

Conclusion

Okhale-1, PAC-Hill have been doing excellently both in FFTs and in CFTs, but being late maturing varieties, which do not fit in a possible Maize/Millet-Wheat cropping pattern particularly in mid and low altitude bari land. Thus, in such situation, fast maturing and higher yielding varieties like NE-1305-46 (128 DAS) will receive attention in trials next year under maize. For the Maize/Millet system, Okhale-1 will continue as the PAC recommended cultivar.

Advanced Varietal Trial on Fingermillet (Relay Cropped with Maize) (High Altitude)

This trial with 10 varieties was carried out on bari land at 1750 m.a.s.l.

Highly significant (1% level) differences in grain yield between cultivars were recorded.

Okhale-1 and PAC-Hill yielded highest (1614 and 1326 kg/ha), respectively, significantly higher than other 8 varieties under test.

Okhale-1 and PAC-Hill also equally performed better with maize (Arun-1), which yielded highest (Maize+Millet) 4419 and 4268 kg/ha respectively.

IE-143 which yielded lowest (143 kg/ha) was matured earliest in (151 DAS), whereas Rampur Local latest in (213 DAS) and highest yielding varieties as PAC-Hill and Okhale-1 in 202 and 195 DAS respectively.

Septoria leaf spot was observed in all varieties at the latter stage of the crop, which did not cause remarkable loss in yield.

Shattering was found low in all the varieties.

PAC-Hill and Okhale-1 were the tallest varieties at 83 and 80 cm respectively, while NE-94 was shortest at 46 cm only.

During field selection Okhale-1 and PAC-Hill looked most promising.

Conclusion

Okhale-1 and PAC-Hill will be tested at the centre under with and without fertilizer conditions, and in farmers fields, as well.

2.8 Fingermillet Plant Population Trial (Under Relay Maize and Mono Conditions) : Mid Altitude

The fingermillet (Var.:Okhale-1) plant population trial with 5 treatments (no. of plant per hectare), was tested as a mono and relay cropped with maize (Var.:Arun-2), on bari land at 1350 m.a.s.l.

A highly significant result in the mean yield of between the sub-plots (Mono and Relay) was observed.

Whereas non-significant result was observed between the plant population level (in the main plot) and inter-action between plant population level and sub-plot treatments.

The highest mean yield of Fingermillet was produced by the treatment no. 5 (3630 kg/ha) as relay crop and treatment no. 3 (4508 kg/ha) as a mono crop, followed by the treatment no. 4 (3233 kg/ha) as relay crop and treatment no. 5 (4377 kg/ha) as a mono crop.

The highest total yield (Maize+Millet) was produced by treatment no. 5 (6463 kg/ha) followed by treatment no. 2 (6219 kg/ha) and treatment no. 4 (6165 kg/ha) and lowest by treatment no. 1 (4929 kg/ha).

Lodging of millet was observed more in mono crop than in relay crop condition.

Conclusion

Twelve hundred fifty thousand (1,250,000) plants/ha of millet yielded highest under relay crop condition and did equally better as mono crop.

N.B.: Treatment No. 1 = 250,000 millet plant/ha
" " 2 = 500,000 " "
" " 3 = 750,000 " "
" " 4 = 1,000,000 " "
" " 5 = 1,250,000 " "

(Maize population 53,333 plants/ha constant).

Lumle Report on Maize and Fingermillet - 1984

C.K. Sen*

ABSTRACT

Field experiments were conducted at the Lumle Agricultural Centre and in its command area on maize and fingermillet. There were 6 experiments on maize and 4 fingermillet. Amarillo del Bajio, Kakani Yellow and Arun-2 were the three top yielders of maize varieties from the FFT conducted in the villages. Results of the NMDP Varietal Trial indicate Arun-4, Arun-2 and Ganesh-2 as superior genotypes of maize. Results of a FFT conducted at the Centre put Arun-1, Ganesh-2 and Arun-2 as the best varieties of maize. In a plant population trial on Arun-2 it was found that higher the population of maize correspondingly greater the yields are. The results of the verification trial on maize suggest that under farmers method of farming an established improved variety with moderate dose of chemical fertilizer can give the highest yield. We have been through the 4th year in maize breeding program which is going on at LAC in collaboration with NMDP. Selected materials have been sent to NMDP for further evaluation during winter.

Results of AVT on fingermillet (Relay) suggest that Okhale-1 and Dhuka Local are the two best varieties of fingermillet to be grown under maize (Kakani Yellow or Arun-2). One million two hundred fifty thousand (1,250,000) fingermillet plants/ha produced the highest yield of fingermillet grain under both relayed and monoculture condition. This has been found in a plant population trial. Results of IET indicate 1002-12, Kalo Bhunde and NE-1102-12 as the three best varieties of fingermillet. Kalo Bhunde, Okhale-1 and NE-3801-2 are the superior genotypes of fingermillet, the results of AVT reveal.

Common rust and cob rot have been noticed as major diseases of maize at LAC and in its command area. Brown rust is the important disease of fingermillet in our area. Army worms and cut worms have been noticed as the major insects in our area.

INTRODUCTION

Lumle Agricultural Centre (LAC) is situated at an altitude of 1675 m with a farm area of approximately 50 hectares. Average annual rainfall recorded at the Centre is 5143 mm (203").

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LAC is carrying out investigational exercises at the Centre and in its target villages on crops in an attempt to find out more suitable technologies for the farmers so that they become well off through their farming pursuits. Extension services are also provided with closely supervised follow-up and back-up.

This report primarily deals with investigation and extension activities carried out by the Centre on maize and fingermillet.

EXTENSION ACTIVITIES

Providing Extension Services to the farmers is one of the major activities (another important one is research) that LAC is carrying out in its command area at the moment. In view of handing over the Project to HMG(N) efforts are being made to channel this part of the LAC's activity to appropriate agencies. This work is under progress.

Supply of inputs to the farmers, conducting village based seed multiplication program, providing seed dressing and grain storage services and running village based training program are the main features of the extension activities that LAC is carrying out successfully.

Organizing quality seed multiplication program in all the regions/Panchayats in the command area; collection, storing and distribution of seed require a great deal of skill and time. How best extension services are provided with improved seed depends how efficiently this part of the extension services are being run. Presently, our field staff are spending a great deal of their time in the above said activities.

The chart given below shows village-produced seed distribution from 1974 to 1984:

Table 1: SEED DISTRIBUTION

S.No.	Year	Maize (kg)		
		Kakani Yellow	Arun-2	Total
01.	1974	28	-	28
02.	1975	443	-	443
03.	1976	380	-	380
04.	1977	700	-	700
05.	1978	3,920	-	3,920
06.	1979	5,526	-	5,526

Contd.../...

Table 1 (Continued)

07.	1980	11,517	-	11,517
08.	1981	15,685	-	15,685
09.	1982	2,395	2,405	4,800
10.	1983	1,926	2,277	4,203
11.	1984	357	1,881	2,238

As the above chart indicates there is a down-trend in seed distribution since 1982. From that year a "cash for seed" program was introduced and since then majority of the farmers are keeping their own seeds. However, we are making sure that they retain good quality seed and seeds are dressed with pesticides. A significant amount of seed goes from farmers to farmers which is not shown in the above chart. We have only those seeds that have gone to farmers through us.

INVESTIGATIONAL EXERCISES

Late maturity, low yielding potentiality, prone to hailstone, susceptible to diseases, prone to lodging and poor response to chemical fertilizers are some of the major problems associated with summer crops in the hills. With the help and assistance from the National Crop Development Program we are carrying out investigational exercises centering around these problems.

The following investigational exercises were carried out at the Centre at the target villages:

A. Maize

1. Farmers' Field Trial on Maize LAC (1984)

The objective of the trial was to test the performance of promising cultivars of maize under the agro-climatic conditions of target villages and also to popularize these varieties among the target farmers. The FFT was put out at 17 locations but the results were obtained only from 13 locations. At the remaining 4 locations the trial was destroyed either by cattle or hailstone.

Result is summarized below:

Grain Yield (t/ha) Obtained From Maize FFT - 1984

S.No.	Loc./Var.	Kakani Yellow	Arun-2	Amarillo Del Bajio	Local
01.	Dhampus	2.457	3.482	2.490	2.974
02.	Dhichok	3.341	4.347	4.307	4.310
03.	Salyan	2.928	3.995	2.922	3.164
04.	Ghandruk*	3.756	4.295	3.439	3.150
05.	Sabet	4.233	4.183	4.628	3.081
06.	Langadi	1.083	0.848	2.117	1.843
07.	Lospar	1.717	1.249	0.968	1.080
08.	Bajung	3.752	2.460	3.643	4.175
09.	Lekhphant	4.995	3.557	4.420	2.579
10.	Nangi	1.499	1.084	1.284	0.984
11.	Sikha	3.441	3.483	3.446	2.861
12.	Ghara	6.548	5.620	7.300	4.899
13.	Paudwar	3.420	3.571	3.691	3.278
	Ave. Yield (t/ha):	3.401	3.244	3.435	2.952
	Ranking	II	III	I	IV
	% Yield increase over local	15.21%	9.89	16.36%	
	Maturity Days	150	141	148	138
	Yield/Day/ha (kg):	22.7	23.0	23.2	21.4

* - Yield difference statistically significant at 5% level.

The analysis of variances is not significant for both individual and combined locations at the 5% level of confidence except at one location, Ghandruk. The pooled analysis of 13 locations indicates Amarillo del Bajio as the top yielder (3.435 t/ha) followed by Kakani Yellow (3.401 t/ha) and Arun-2 (3.144 t/ha). On the whole Amarillo del Bajio has been the top yielder continuously for the last three years. The local cultivar was the earliest in maturity (138 days) closely followed by Arun-2 (141 days). Among the tested lines Kakani Yellow was observed as the latest variety which took 151 days to mature. While looking across the locations Kakani Yellow was found exhibiting more yield stability than any other variety. However, it outyielded all other varieties at 3 locations only (of the 13) as compared to Amarillo del Bajio at 4 locations and that of Arun-2 at 5 locations. All the three improved varieties namely Amarillo del Bajio

Kakani Yellow and Arun-2 outyielded local by 16.362%, 15.21% and 9.892% respectively.

Arun-2 appears to be a popular variety among the farmers because of its earliness.

2. NMDP Varietal Trial (HMG/N, 1984)

The objective of the trial was to find out superior maize genotypes for different regions of the country. The trial was designed in RBD with 3 replications. Chemical fertilizer was applied @ 120:60:40 kg NPK/ha plus compost @ 10 t/ha. Eleven varieties were tried against local.

Result: The result is summarized below:

(NMDP Varietal Trial, Mean of 3 reps.)

Sl. No.	Variety	Plant Ht./Plot	Days to 50%Silk.	Maturity Days	Plant Ht in cm	Root Lodging %	Stalk Lodging %	Ear Ht. in cm	Husk Cover (B.T.*)	No.of ear/Plot	Com.Rust	Cob Rot %	Stalk Rot %	P.R.** %	Helminthosporium	Culvularia	Mean Grain Yield t/ha at 12% moisture	Yield/Day
01.	Ganesh-2	28	96	145	219	3	1	143	2	13	6	10	0	0.33	1.66	3	4.276(3)	0.029
02.	Manakamana-2	30	96	145	224	1	0	125	2	14	3	6	0	1.0	1.66	3	3.706(8)	0.025
03.	Mana-1	30	96	145	213	1	1	139	4	14	3	10	0	0	1.66	3	3.281(10)	0.022
04.	Rampur-2	30	90	142	218	1	0	123	1	14	4	4	0	0.33	1.33	4	3.933(5)	0.027
05.	Rampur-1	32	96	145	231	0	0	138	3	14	2	6	0	0.66	3.0	4	3.135(11)	0.021
06.	Arun-4	31	78	133	196	1	0	103	2	15	2	14	0	0.33	2.33	3	4.487(1)	0.033
07.	Arun-1	28	78	133	206	1	0	107	1	15	3	20	0	0.33	2.33	4	3.592(9)	0.027
08.	Pioneer-6181	30	96	148	203	0	0	113	3	15	1	18	0	0.33	0.66	2	4.145(4)	0.028
09.	Khumal Y.	27	90	140	220	4	0	12[illegible]	0	13	5	20	0	2.33	2.66	3	3.281(10)	0.023
10.	Rampur	29	88	145	227	1	0	138	2	13	3	4	0	0.33	0	3	3.758(6)	0.025
11.	Arun-2	28	77	133	209	1	0	105	2	14	2	29	0	0	0.66	3	4.380(2)	0.032
12.	Local	31	80	133	241	8	0	144	0	17	5	0	0	0.66	2.66	4	3.719(7)	0.027
	F - test (0.05)																NS	
	CV %																15.021	

* - B.T. = Bare Tips

** - P.R. = Pythium Rot

Com. Rust = Common Rust.

The highest mean grain yield was produced by Arun-4 (4.487 t/ha) followed by Arun-2 (4.380 t/ha) and Ganesh-2 (4.276 t/ha). Arun-2, Arun-1, Arun-4 and local each took 133 days to mature and were the earliest cultivars whereas Pioneer-6181 was the longest duration variety (148 days) among the tested ones. Root lodging was observed highest in local (8 %) followed by Khumal Yellow (4%) and Ganesh-2 (3%). Rampur-1 and Pioneer-6181 did not lodge. Ganesh 2 and Manakamana-1 each had 1% of lodging and the rest of the varieties were free from stalk lodging. Khumal Yellow and local were found free from husk cover problem and rest of the cultivars showed varying degree of husk cover problem. Local was the tallest (241 cm).

Arun-2 was observed having the highest percentage of cob rot (29%) (Fusarium spp) followed by Khumal Yellow (20%), Arun-1 (20%), Pioneer-6181 (18%) and Arun-4 (14%). Pythium rot was observed in all the varieties except in Manakamana-1 and Arun-2. Helminthosporium blight (Helminthosporium turcicum) was noticed in all the varieties except in Rampur Composite. Common rust (Puccinia sorghi) was observed in all the tested varieties with more severity in Ganesh-2, local, Khumal Yellow and Rampur-2.

3. Farmers' Field Trial on Maize (HMG/N), 1984

The objective of the exercise was to find out the superior maize genotypes suitable under different agro-climatic regions. The trial was put out using R.B. Design with two replications. The plot size used was 6 m^2. There were 10 treatments including local and Kakani Yellow.

Result: The result is summarized below:

(FFT on Maize, Mean of 2 Replications)

Sl. No.	Variety	Plant Stand/Plot	Days to 50% Silk.	Maturity Days	Plant Ht. cm	Lodging % Root	Lodging % Stalk	Ear Ht. in cm	Husk Cover (D.T.*)	No. of ear/Plot	Disease Scoring (0-9) Common Rust	Cob Rot %	Stalk Rot %	P.R.** %	Grain Yield t/ha at 12% moisture	Yield/Day
01.	Arun-1	30	77	133	198	0	0	96	3	28	3	15	0	3	4.309 (1)	0.032
02.	Arun-2	31	75	133	181	0	0	93	2	28	3	29	16	4	3.808 (3)	0.027
03.	Arun-4	29	76	133	164	0	0	76	2	26	4	22	0	5	3.198 (9)	0.024
04.	Mana-1	31	94	143	189	0	0	101	3	23	2	11	00	6	2.097 (10)	0.014
05.	Mana-2	30	90	140	186	7	0	96	2	25	4	36	0	7	3.659 (5)	0.026
06.	Khumal Y.	29	85	141	196	0	0	104	1	27	3	37	0	5	3.521 (6)	0.024
07.	Ganesh-2	30	85	142	221	6	0	116	2	27	3	33	0	3	4.099 (2)	0.028
08.	Local (Ck.)	30	80	135	253	6	0	146	0	30	4	8	0	3	3.458 (7)	0.025
09.	Amarillo del Bajio	32	94	143	229	6	22	161	1	28	2	30	16	6	3.456 (8)	0.024
10.	Kakani Y.	30	94	143	245	6	4	134	2	26	2	17	0	3	3.671 (4)	0.025
	F - test (P = 0.05)														NS	
	CV %														21.278	

* - D.T. = Bare Tips; ** - P.R. = Pythium Rot.

The highest mean grain yield was produced by Arun-1 (4.309 t/ha) followed by Ganesh-2 (4.099 t/ha) and Arun-2 (3.808 t/ha). Last years top yielder Mana-2 ranked 5th this year.

Arun-1, Arun-2 and Arun-4 were the earliest maturing varieties (each took 133 days) whereas Manakamana-1, Amarillo del Bajio and Kakani Yellow were the longest duration varieties (each took 143 days). Local was the tallest variety (253 cm) and Arun-4 was the dwarf cultivar (164 cm .

Root lodging was observed in Manakamana-2, Ganesh-2, Local, Amarillo del Bajio and Kakani Yellow. Stalk lodging was observed highest in Amarillo del Bajio (22%)

Cob rot disease (Fusarium spp) was observed in all the varieties with the highest in Khumal Yellow (37%) and the lowest in local (8%).

4. Plant Population Trial on Maize (1984)

The objective of the trial was to find out the highest yielding

plant population under the monoculture practice under the agro-climatic condition of LAC. Arun-2 was the variety used. The trial was designed in RBD with 4 replications. Planting was done on 27 April 1984. Plot size used was 6 m^2. Fertilizer was used @ 60:30:30 kg 40, 50, 53 (Check), 60, 70, 80 and 90 thousand plant/ha. The soil was treated with 10% BHC @ 20 kg/ha prior to planting.

Result: The result is summarized below:

Plant Population Trial on Maize, Mean of 4 Replications)

Trt. No.	Treatment	Mean Grain Yield (t/ha) 12% Moisture 1984	1983
01.	75 cm X 25 cm (53,333)	3.508 (4)	4.634 (5)
02.	50 cm X 22.22 cm (90,009)	2.971 (7)	6.111 (1)
03.	50 cm X 25 cm (80,000)	4.380 (1)	5.346 (2)
04.	50 cm X 28.57 cm (70,003)	3.916 (2)	5.050 (4)
05.	50 cm X 33.33 cm (60,006)	3.190 (5)	5.269 (3)
06.	50 cm X 40 cm (50,000)	3.825 (3)	4.105 (7)
07.	50 cm X 50 cm (40,000)	3.099 (6)	4.202 (6)
	F - test (0.05)	NS	HS
	CV %	32.846	15.948
	LSD at 5%	-	1.033 t/ha
	LSD at 1%	-	1.399 t/ha

The highest mean grain yield was produced by treatment no. 3 (80,000 plants/ha with 50 cm X 25 cm spacing) (4.380 t/ha) followed by treatment no. 4 (70,003 plants/ha with 50 cm X 28.57 cm) (3.916 t/ha) and treatment no. 6 (50,000 plants/ha with 50 cm X 40 cm) (3.285 t/ha). Last years top yielder, treatment no. 2 (90,000 plants/ha) was last this year. Nevertheless, there is indication that higher the maize population greater the yield would be under the monoculture condition.

5. Verification Trial On Maize (HMG/N) 1984

The objective of the trial was to observe the effects of different technological inputs and also to find out the economic response of nitrogen application. The trial was put out on 29 April 1984 with

no replication. The soil was treated with 10% BHC @ 20 kg/ha prior to planting.

Result: The result is summarized below:

(Verification Trial on Maize, none Replicated)

Trt. No.	Treatment	Grain Yield t/ha at 12% Moisture
01	Farmer's Variety + Farmer's level of FYM + Farmer's method of planting	1.609 (2)
02	Farmer's variety + 30 kg N/ha side dressing + seeding behind plough	0.802 (5)
03	Improved variety (Khumal Yellow) rest same as Trt.No. 01	1.043 (3)
04	Same as Trt.No. 3 + 30 kg N/ha side dressing	2.094 (1)
05	Same as Trt. No. 4 but planting behind plough alternating 2 passages (1st plough passage-seed, 2 and 3rd empty and 4th again seed)	0.824 (4)

Since the trial was a non-replicated one, henceforth, the dats was not put to any statistical test. However, on the yield basis, the treatment no. 4 (Improved variety with 30 kg N/ha) was the top yielder followed by treatment no. 1 (Farmer's variety + Farmer's level of FYM + Farmer's method of planting and treatment no. 3 (Improved variety with farmers method).

6. Breeding Work on Maize (HMG/N) 1984

In close collaboration with the National Maize Development Program, Rampur, we are carrying out a breeding program on high land materials of maize. The objective of the exercise is to develop the superior genotypes of maize for higher hills. This is the 4th year since we participated in this program.

The following were the breeding materials planted at LAC:

1.	Ganesh Half-sib	(Lumle selection)	1-226 families
2.	"	(Rust resistant, Lumle set)	227-296 "

3.	Ganesh Half-sib (Kakani set)	297-424 families
	Total families:	423 (Female lines)
	Total No. of male	89 (lines)

Selected materials from the above breeding lines have been sent to NMDP, Rampur for further breeding/evaluation during the winter season.

B) FINGERMILLET

This is now the third year running since we participated in the fingermillet development program. During the year we took some more additional investigational works which are the part of the national program. The trials are AVT (Relay), plant population, IET and AVT and they are reported below:

1. AVT on Fingermillet (Relay) (HMG/N, 1984)

The objectives of the trial were to test 4 varieties that have performed well in the past and relay them into the canopies of two maize varieties in order to isolate the populations) that perform the best under these conditions. Also, the secondary objective was to observe how the behaviour of the quantitative and qualitative agronomic characteristics of the varieties of fingermillet crop were affected by the two different maize varieties. The trial was put out in RBD with 4 replications. Plot sizes used were 22.5 m^2 (main plot) and 3.75m^2 (sub-plot). Plant spacings were given 75 cm X 25 cm (maize) and 10 cm X 10 cm (fingermillet). Fertilizers were applied @ 60:30:0 kg NP/ha (maize) and 20:0:0 N/ha (fingermillet). Maize varieties used were Arun-2 and Kakani Yellow.

Result: The result is summarized below:

(AVT on Fingermillet (Relay), Mean of 4 Replications)

Trt. No.	Variety	Relayed with Kakani Yellow: Plant Stand/Plot	Heading Days	Flowering Days	Maturity Days	Plant Height (cm)	Mean Grain Yield (t/ha)	Relayed with Arun-2: Plant Stand/Plot	Heading Days	Flowering Days	Maturity Days	Plant Height (cm)	Mean Grain Yield (t/ha)	Yield / Day
1	Okhale-1	62	134	144	194	61	0.540 (2)	65	134	144	193	67	0.433 (1)	0.002
2	NE-1104-13	59	108	118	179	82	0.133 (3)	63	108	118	177	83	0.094 (3)	0.0005
3	IE-143	61	86	96	148	51	0.053 (4)	46	86	96	149	48	0.047 (4)	0.0003
4	Bhuka Local	60	130	140	193	76	0.747 (1)	61	130	140	190	80	0.417 (2)	0.002
	F - test (0.05)						HS						S	
	CV %						58.912						81.452	
	LSD at 5%						0.347 t/ha						0.305 t/ha	
	LSD at 1%						0.497 t/ha						-	

Okhale-1 produced the highest mean grain yield (0.433 t/ha) followed by Bhuka Local (0.417 t/ha) and NE-1104-13 (0.094 t/ha) when relayed under the canopy of Arun-2 maize. The result is statistically significant at the 5% level of confidence.

The same fingermillet varieties were also relayed into the canopy of Kakani Yellow maize. In this case, Bhuka Local outyielded all other varieties by producing mean grain yield of 0.747 t/ha followed by Okhale-1 (0.540 t/ha) and NE-1104-13 (0.133 t/ha). The result is statistically highly significant at 1% level of confidence. Okhale-1 and Bhuka Local were the late maturing types whereas IE-143 was the earliest variety.

The result of the first year trial suggests that Okhale-1 is a suitable variety to be grown under the canopy of Arun-2 maize. Whereas, Bhuka Local seems be a better choice to be relayed with Kakani Yellow.

a) Fingermillet relayed with maize:

The highest mean grain yield was produced by treatment no. 5 (1,250,666 plants/ha) (2.673 t/ha) followed by treatment no. 3 (752,000 plants/ha) (2.033 t/ha) and treatment no. 4 (1,000,000 plants/ha) (1.923 t/ha). The result is significant at the 5% level of confidence. However, these three top yielders are not significantly different from each other at the 5% level of confidence.

b) Fingermillet monoculture:

The highest mean grain yield was produced by treatment no. 5 (1,252,000 plants/ha) 3.520 t/ha) followed by treatment no. 4 (1,000,000 plants/ha) (3.047 t/ha) and treatment no. 3 (752,000 plants/ha) (2.884 t/ha). The results of the first year trial suggest that higher the plant population correspondingly greater the yields are.

3. Initial Evaluation Trial on Fingermillet (HMG/N) - 1984

The objectives of the trial were to test 16 experimental lines of diverse geographic origin at 3 locations in order to isolate the population(s) which perform the best under each location. Also, the secondary objective was to observe the behaviour of the quantitative and qualitative agronomic characteristics of each variety. These lines were tested under monoculture condition. The trial was put out in Balanced Lattice Design with 2 replications. Fertilizer was used @ 40:40:20 kg NPK/ha. Plot size used was 4 m^2. Nursery was kept on 5.5.1984 and transplanting was done on 27.6.1984.

2. Plant Population Trial on Finger Millet - 1984

The objective of the exercise was to test the released variety (Okhale-1) of fingermillet recommended for the mid to high hills at 5 different plant populations (252,000; 500,00, 752,000, 1,000,000; and 1,252,000 plants/ha). The trial was put out in RBD with 4 replications. Fertilizer was used @ 60:30:0 kg NP/ha (for maize), 20:0:0 kg N/ha (for millet relay) and 40:40:20 kg NPK/ha (for millet monoculture). The plot sizes used were: 7.5 m^2 (Millet for relay) and 2.5 m^2 (millet for monoculture). Nursery was kept on 5.5.1984 and subsequent transplanting was done on 28.6.84.

Result: The result is summarized below:

Plant Population Trial on Fingermillet

Maize variety : Arun-2

Fingermillet variety : Okhale-1

(Mean of 4 Replications)

Sl.	Fingermillet Relayed into (A) Relay				Fingermillet (B) Moculture		
		Yield t/ha					
No.	Treatments	F.millet	Maize	F.Millet +Maize	Treatments	Yields t/ha	Yield/ day
1.	188 plants/ plot or 250, 666 plants/ha	1.173 (5)	3.118 (3)	4.291 (5)	63 plants/plot or 252,000 plants/ha	2.470 (4)	0.013
2.	375 plants/ plot or 500,000 plants/ha	1.690 (4)	2.292 (2)	4.982 (3)	125 plants/plot or 500,000 plants/ha	2.454 (5) (5)	0.013
3.	563 plants/ plot or 750,000 plants/ha	2.033 (2)	3.416 (1)	5.449 (1)	188 plants/ lot or 752,000 Plants/ha	2.884 (3)	0.015
4.	750 plants/ Plot or 1,000,000 plants/ha	1.923 (3)	3.033 (4)	4.958 (4)	250 plants/plot or 1,000,000 plants/ha	3.047 (2)	0.016
5.	938 plants/ plot or 1,250,666 plants/ha	2.673 (1)	2.532 (5)	5.205 (2)	313 plants/plot or 1,252,000 plants/ha	3.520 (1)	0.019
	F-test (0.05)	S	NS	NS		NS	
	CV %	27.514	18.316	21.63		22.052	
	LSD	0.805t/h	-	-		-	

Result: The result is summarized below:

(IET on Fingermillet, Mean of 2 Replications)

Trt. No.	Variety	Plant Stand / Plot	Heading Days	Flowering Days	Maturity Days	Plant Height (cm)	Lodging %	Shattering %	Disease (0-9) Brown Rust	Mean Grain Yield (t/ha)	Yield / Day
01.	NE-1304-1	200	124	144	185	74	7	1	4	1.425 (7)	0.007
02.	1002-12	198	129	139	185	81	6	2	5	2.088 (1)	0.011
03.	NE-86	154	99	109	152	57	5	2	5	0.738 (13)	0.004
04.	NE-109	193	90	100	146	75	5	2	4	1.463 (6)	0.010
05.	NE-1001-1	183	120	130	185	72	6	3	4	1.463 (6)	0.007
06.	NE-20	179	94	104	140	48	5	2	4	1.475 (5)	0.010
07.	NE-52	157	76	91	140	45	5	2	6	0.575 (14)	0.004
08.	NE-6401-26	191	92	102	149	60	5	2	5	0.838 (11)	0.005
09.	Dalle Local	198	140	150	194	75	7	1	5	1.000 (10)	0.005
10.	NE-6401-21	193	96	104	150	54	4	3	5	0.750 (12)	0.005
11.	NE-1305-46	186	100	110	147	57	5	2	7	1.075 (9)	0.005
12.	NE-2101-21	196	122	132	170	82	7	3	2	1.725 (4)	0.010
13.	NE-1102-12	198	130	140	184	91	6	2	5	1.738 (3)	0.009
14.	NE-1704-2	149	81	91	136	33	4	3	4	0.350 (15)	0.002
15.	NE-50	188	100	109	149	59	5	3	6	1.238 (8)	0.008
16.	Kalo Bhunde (Local Check)	197	130	140	185	72	8	2	4	1.825 (2)	0.009
	F-test (0.05)									NS	
	CV %									37.632	

1002-12 was the top yielder (2.088 t/ha) followed by Kalo Bhunde (Check) (1.825 t/ha) and NE-1102-12 (1.738 t/ha). NE-1704-2 matured earliest (136 days) whereas Dalle (Local) was the longest duration variety (194 days). NE-1102-12 measured 91 cm and was the tallest cultivar. NE 1704-2 was the dwarfest (33 cm) among the tested cultivars. All the varieties were found prone to lodging and shattering. Brown rust was observed in all the lines with varying degree. NE-1305-46 was the most susceptible line.

4. Advanced Varietal Trial on Fingermillet - 1984

The objective of the trial was to test 10 experimental lines of diverse geographic origin at 7 locations in order to isolate the population(s) that would perform well at each site. The best population(s) would be advanced to farmers field trials on the following year. In addition to this, the secondary objective of the AVT was to observe the quantitative and qualitative agronomic characteristics of each variety. The trial was put out in RBD with 4 replications. Fertilizer was used @ 40:40:20 kg NPK/ha. Plot size maintained was 2 m^2. Nursery was kept on 5.5.1984 and subsequently transplanting was done on 26.6.1984.

Result: The result is summarized below:

(AVT on Fingermillet, Mean of 4 Replications)

Trt. No.	Variety	Plant Stand/Plot	Heading Days	Maturing Days	Plant Ht. in cm.	Mean Grain Yield kg/ha		Yield / Day
01.	NE-94	94	100	145	52	212.5	(8)	1.465
02.	NE-1703-34	91	91	150	73	512.5	(6)	3.416
03.	NE-6401-26	92	108	183	84	1500	(4)	7.978
04.	Okhale-1	94	133	187	87	1775	(2)	9.491
05.	Dalle-1	89	128	188	78	537.5	(5)	2.859
06.	NE-3801-2	99	119	182	88	1662.5	(3)	9.134
07.	IE-143	94	72	147	53	237.5	(7)	1.615
08.	NE-1305-55	99	100	146	59	175	(9)	1.198
09.	Kalo Bhunde	96	129	192	90	2237.5	(1)	11.653

F-test (0.05)	HS
CV %	5.718
LSD at 5%	32.832 kg/ha
LSD at 1%	44.492 kg/ha

The result is statistically highly significant at the 1% level of confidence. Kalo Bhunde produced the highest mean grain yield (2237.5 kg/ha) followed by Okhale-1 (1775 kg/ha and NE-3801-2 (1662.4 kg/ha). Kalo Bhunde was observed significantly different from all other treatments at the 1% level of confidence. Okhale-1 was also found

significantly different from all those varieties ranked 3rd and onwards. During the last year also it was Kalo Bhunde which had outyielded 20 other tested varieties.

All the entries were found susceptible to brown rust. IE-143 was the earliest cultivar whereas Kalo Bhunde and NE-6401-26 were the latest varieties.

MINIKIT DEMONSTRATION ON FINGERMILLET

Minikit demonstrations were put out at 12 different locations in the LAC command area of which were obtained from 10 locations. At the remaining two locations the crop was destroyed by insects in the nursery. An improved variety, Okhale-1 was tested against local types. It is interesting to note that Okhale-1 was found outyielding local types at all the locations. On an average, it outyielded local by 36.365 %.

The locationwise yields are presented below:

Sl. No.	Location	Varieties (Yield t/ha)		Remarks
		Okhale-1	Local	
01.	Ghandruk	1.340	1.180	
02.	Keng	1.840	0.600	
03.	Salija	2.210	1.720	
04.	Sikha	1.040	1.030	
05.	Durlung	1.867	1.067	
06.	Histan-Mandali Bensi	2.110	1.500	
07.	Lumle	2.500	2.000	
08.	Dangsing (Sabet)	2.000	1.950	
09.	Dhampus	1.180	0.820	
10.	Histan Hill Area	1.500	1.030	
	Average Yield :	17.587	12.897	
	% Increase Over Local	36.365%		

Discussion On Lumle Report

K.P. Upadhyaya : Dear Mr. Sen, majority of the farmers in Eastern Development Region are reluctant to apply the full recommended doses of NPK in maize crop. Is it not useless to expect yield higher than local varieties from the improved ones ? Which variety(ies) will be most suitable at low fertility level and for growing in winter and spring under rainfed conditions, especially in Terai ?

Sen : As we donot work in the Terai area, therefore, it would not be proper to recommend CVS for the Terai region. Our target farmers do not apply chemical fertilizers, however, they apply an appreciable quality of FYM and improved varieties have been doing well.

Upadhyaya : The rice straw yield is generally not more than 7 tons/ha at the most whereas your result (Page 21) show even upto 25 tons/ha. I surprise, is it the exact date of straw weight?

Sen : This was the field weight (harvested and weighted at the plot).

B. Upadhyaya : What is the organism causing brown rust in fingermillet at Lumle ?

Sen : We want people like you to come and help us to identify diseases and casual organism and till us what should we do.

K.D. Sayre : In the AVT on Fingermillet (Relay), isn't it surprising to encounter higher FM yields when relayed with the later maturing, taller Kakani Yellow as compared to the lower FM yields when relayed with Arun. Please comment.

Sen : We also expected that fingermillet under Arun-2 would yield more as compared to K. Yellow, but this is the result what we obtained. However, this is the first year result and it will be interesting to see what results we obtain.

Summer Crop Report

Tinau Watershed Project

K.B. Kadayat*

" One Cannot Polish a Gem Without Friction "

(1) DEMONSTRATION PROGRAM OF SUMMER CROPS

In 1984/85 (2040/2041) the ADO, through its field staff conducted 47 results demonstrations of 6 summer crops in 45 Panchayats of Palpa district (total : 65 Panchayats). The total result demonstration area amounts to 660 ropani (33 ha). The result demonstration program has been combined with farmers' field days.

In detail, the following result demonstrations have been carried out:

a)	Rice demonstrations (main season)	213 sets
b)	Spring rice demonstrations	20 sets
c)	Maize demonstrations (main season)	100 sets
d)	Spring maize demonstrations	60 sets
e)	Mung demonstrations	35 sets
f)	Groundnut demonstrations	2 sets
g)	Lentil demonstrations	15 sets
h)	Dhaincha demonstrations	30 sets

(2) RICE DEMONSTRATIONS (MAIN SEASON)

a) Bags of minikit were damaged and wet, caused germination problem.

b) Un-even numbers of minikit pockets of different varieties resulting in difficulties to compare improved varieties with local.

c) Growth, tillering and heading problems were reported in case of BG-400-1 and Sabitri.

d) Early maturing varieties (CH-45, Laxmi and Bindeshwari) were heavily attacked by insects.

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* Assistant Agronomist, Tinau Watershed Project.

SABITRI

Farmers' Reactions

a) Only 50% of farmers liked this variety and other 50% clearly rejected when comparing with local.

b) Germination was poor

c) Panicles were not dropping type and were short.

d) Tillering was not satisfactory.

e) Yield:

i) Highest	2800 kg/ha
ii) Lowest	800 kg/ha
Average	1500 kg/ha

HIMALI

Farmers' Reactions

a) 50% of farmers liked this variety when compared with local.

b) High tillering

c) Maturity

d) Long panicles

e) Taste liked by farmers

f) Straw liked by animals

g) Yield:

i) Highest	4500 kg/ha
ii) Lowest	2000 kg/ha
Average	2900 kg/ha

B.G. 400-1

Farmers' Reactions

a) Majority of farmers' did not like this variety when comparing with local

b) Short straw height

c) Late maturing

d) Tillering, heading and yield not satisfactory

e) Yield:

i) Highest	3000 kg/ha
ii) Lowest	500 kg/ha
iii) Average	1500 kg/ha

CH-45

Farmers' Reactions

a) This variety is not liked by farmers as main season rice.

b) Early maturity creates the problem of insects and birds.

c) Short straw height

d) Yield:

i) Highest	2600 kg/ha
ii) Lowest	1000 kg/ha
iii) Average	2050 kg/ha

LAXMI AND BINDESHWARI

Farmers' Reactions

a) No clear conclusions were drawn about likings of Laxmi and Bindeshwari when compared with local. Thus need further observations to be collected.

b) Yield:

	Highest (kg/ha.)	Lowest (kg/ha)	Average (kg/ha.)
Laxmi	3800	2000	2700
Bindeshwari	3100	1500	2800

JANAKI AND DURGA

Farmers' Reactions

a) Janaki and Durga are liked by farmers when compared with local.

b) Straw height, tillering, heading and grains were satisfactory

c) Appearance of smut in few cases

d) Yield:

	Highest (kg/ha)	Lowest (kg/ha)	Average (kg/ha.)
Janaki	3400	1500	2770
Durga	4000	1800	3000

(3) SPRING RICE DEMONSTRATIONS

Farmers' Reactions

a) K-39 is liked by farmers and definitely superior when compared with local.

b) It needs further comparisons with CH-45 and local

c) Fits well and in a cropping pattern. (Rice-Rice-Wheat)

d) Threshing difficulty was reported in K-39

e) Yield:

i) Highest	3100 kg/ha
ii) Lowest	2400 kg/ha
Average	2685 kg/ha

(4) MAIZE DEMONSTRATIONS (MAIN SEASON)

a) Thanks to NMDP for sending minikits packets exactly as discussed in last seminar.

b) It looks like Khumal Yellow is liked in altitude above 900 metres and Rampur Composite liked below 900 metres when compared with local.

c) Manakamana looks like to be superior to Khumal Yellow in altitude above 900 metres. But needs further testing.

d) We like to request for high altitude varieties in Palpa above 1200 metres in coming season.

KHUMAL YELLOW

Farmers' Reactions

a) Resistant to lodging, nice cob filling better taste even in roasting and nice shiny grains.

b) Mostly two cobs per plants

c) Maturity at the same time as local

d) High yielding than Rampur Composite and Local in altitude above 900 metres.

e) Yield:

i) Highest	5100 kg/ha
ii) Lowest	2000 kg/ha
Average	3600 kg/ha

MANAKAMANA

Farmers' Reactions

a) High yielding, smaller in height and early maturing than local and Khumal Yellow in altitude above 900 metres.

b) Size of cobs bigger, attractive and nice filling

c) Husk cover is better than Khumal Yellow

d) Yield:

i) Highest	5350 kg/ha
ii) Lowest	2500 kg/ha
Average	3700 kg/ha

RAMPUR COMPOSITE

Farmers' Reactions

a) High yielding, taller, bigger size of cobs than Khumal Yellow in altitude below 900 metres.

b) Husk cover is not satisfactory.

c) Yield:

i) Highest	5600 kg/ha
ii) Lowest	1900 kg/ha
Average	3400 kg/ha

(5) SPRING MAIZE DEMONSTRATIONS

ARUN

a) This is the third year in row that Arun is definitely superior than local in spring season.

b) There is a high demand of Arun seed

c) Yield:

i) Highest	3900 kg/ha
ii) Lowest	800 kg/ha
Average	2537 kg/ha

(6) MUNG DEMONSTRATIONS

a) Pusa Baisakhi is still satisfactory than local

b) Palpa would like to test another improved varieties of mung, having following characteristics:

i) Same picking time

ii) Early maturing

iii) Less affected by insects

c) Yield:

i) Highest	1625 kg/ha
ii) Lowest	400 kg/ha
Average	772 kg/ha

(7) LENTIL DEMONSTRATIONS

We do not have any predictable data on lentil as farmers do not react.

(8) GOUNDNUT DEMONSTRATIONS

a) Variety B-4 is satisfactory. But needs further observations with other improved varieties

b) Problem of rats were reported

c) Yield:

i) Highest	1200 kg/ha
ii) Lowest	800 kg/ha
Average	1000 kg/ha

(9) DHAINCHA DEMONSTRATIONS

Green manure "Dhaincha" is still liked by farmers and its seed is highly demanded.

(10) ACKNOWLEDGEMENTS

Finally, I would like to express my thanks to Ulrich Scheuermeier (Agriculture Advisor of the TWP) for discussing the results of the demonstrations.

But, particularly like to express my sincere thanks to all the field staff, J.T./J.T.A. of the ADO, Palpa for their good performance and loyalty, which enabled me to put this report in presentable form.

Report On Out-Reach Research Activities On Maize

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Research in Research Station is for the purpose of developing technologies which farmers can use on their farm to increase their production, improve their nutritional balance, their incomes or any combination of such benefits. The technologies that are available from the station research is required further research on them on farmer's farms.

The basic reason for this is that small subsistence farmers have their reservation in accepting recommended technologies that have been developed on station by researchers and promoted through Agriculture Extension Programs. It is probably because the technologies are not well tested and demonstrated under the farmers conditions and high risks associated on them. In other words, the technologies do not fit the circumstances of farmers. Thus the researchers task is to incorporate knowledge of farmer's circumstances into the design of technologies so that they are consistent with those conditions. This needs agricultural researchers direct participation with farmer at their field in testing or formulating improved package of practices under their physical and socio-economic limitations. This is the over all objectives of Out-Reach Research.

With this understanding, NMDP has been conducting Out-Reach Research Activities in cooperation with Farms, Stations, ADO's and Agriculture Development Projects. During 1984 summer and winter following on farm research experiments were conducted.

I. Farmer's Field Varietal Trial on Summer and Winter Maize
II. Management Trial on Winter Maize, and
III. Minikit Demonstrations.

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I. Farmer's Field Varietal Trials (Summer and Winter Set)

As stated earlier Farmer's Field Trial plays a key role in the adaptation process of an "innovation". Thus, during the monsoon and winter season of 1984, a number of farmer's field varietal trials on maize (Zea mays L.) were conducted by Agriculture Botany Division, Kakani, Kabhre Agriculture Farm, Lumle and Pakhribas Agriculture Centres. The winter sets were planted only at Chitwan by NMDP. Here are some objectives of these trials:

A) To compare the grain yield performance of recommended and promising varieties with farmer's existing variety,

B) To enable farmer's to be familiar with different improved varieties and express their varietal preference,

C) To recommend the high yielding and cropping hazards resistant variety for different agro-climatic region.

MATERIALS AND METHODS

In total fifty summer sets of these trials were sent to different Farms, Stations and Agriculture Development Projects including NMDP's four command districts. But the results of summer sets were obtained from Agriculture Botany Division, Kakani and Kabhre Agriculture Farms, Lumle and Pakhribas Agriculture Centres. The poor feed-back is a serious loss of NMDP's materials and the reasons for this might be many but the main is due to unusual cropping hazards. In winter there were eight sets of varietal trials at eight locations in Chitwan but the results were obtained from four locations. The other four were severely damaged by birds.

A Randomized Complete Block Design (RCBD) with three replications, was used both for summer and winter sets but the trials done by Lumle Agriculture Centre was replicated twice with some additional treatments. Pakhribas Agriculture Centre conducted this trial at four locations at the almost same ecosystem making locations as a replication and they too added some treatments. There were four treatments at Khumal, Kakani and Kabhre locations two promising varieties, one white grain type and other yellow one with standard check Khumal Pahenlo and local check farmer's variety. The

treatments in winter at Chitwan location were Manakamana-1 and Rampur-1, both are white grain type followed by Manakamana-2 and Rampur-2 with yellow grain plus Rampur Composite and Farmer's Local. They were randomly arranged in each block. Individual plots were of 3m x 4.5 or 5 m x 3 m in size, spaced 75 cm x 25 cm apart. Two seeds per hill were planted and was thinned at 3 to 4 leaf stage to one plant per hill.

The level of NPK applied in case of Khumal, Kakani and Kabhre were 60:30:0 kg/ha. Half N and all P_2O_5 were applied as a basal dose in 4 to 5 cm deep furrow followed by planting and remaining half N was side-dressed after 35 to 40 days of planting. The fertilizer application rates at LAC and Chitwan was 90:45:45 NPK kg/ha.

The yields were determined from central two rows and the grain moisture percentage was determined from 10 to 15 sampled ears and the final yields were adjusted to 15% moisture. For each location the date of planting, harvesting and the name of cooperating farmer is given on respective tables.

RESULTS AND DISCUSSIONS

The mean grain yield of individual location during summer and winter seasons are presented in Tables 1, 2 and 3. There was no significant different in yield of all four genotypes of maize at Khumaltar and Kakani at Kabhre they were found significant at both location. At Kabhre, Manakamana-2 was superior to other three varieties and farmers local was the lowest in yield. However, at both locations the promising varieties Manakamana-1 and 2 and standard check, Khumal Pahenlo were at par to each other.

The overall mean grain yield of Khumaltar, Kakani and Kabhre locations indicated that Manakamana-2 (4373 kg/ha) produced the highest yield, however, range of differences among the three varieties was found near to close.

Mean grain yield of Lumle and Pakhribas Agriculture Centre are given in Table-2. At both the centres, the genotypes did not differ significantly. However, Arun-1 (4309 kg/ha) and Ganesh-2 (4099 kg/ha) were the first and second highest yielder at Lumle Agriculture Centre but, at Pakhribas, Manakamana-1 (3416 kg/ha) produced the highest yield but at Lumle this

promising variety gave the lowest yield.

Mean grain yield of winter sets varietal trial conducted at Chitwan District in 1984, are given in Table 3. The analysis of variance indicated that the six maize varieties did not differed significantly at Jutpani, Gunjanagar Ward No.6 and Gunjanagar Ward No. 5 locations but differed significantly at Panchkanya.

At Jutpani, Manakamana-2 (5511 kg/ha) produced the highest grain yield and the lowest yielder was farmer's local (3996 kg/ha). The variety Manakamana-1 (4618 kg/ha) was the highest yielder at Panchkanya and it differed significantly with Rampur-2, (3261 kg/ha). Rampur Composite (3272 kg/ha) and farmer's local (3393 kg/ha).

Mean grain yield averaged over all sites indicated that Manakamana-2 was the best yielding variety and Rampur-2 and Rampur Composite were almost equal to it.

CONCLUSION

At most of the sites, the maize genotypes under test did not differ significantly. However, the promising variety Manakamana-2 produced the highest grain yield followed by recommended variety Khumal Pahenlo. At one location Arun-1 gave the highest yield followed by Ganesh-2 and Manakamana-2 and Manakamana-1. So, from this one year study we can not conclude the yielding potentiality of tested genotypes. It needs further study.

II. Farmer's Field Management Trial On Maize in Chitwan - 1984 Winter

INTRODUCTION

In general, improved maize grain yield per unit farmer's field is low. The cause of low production may be either due to planting method or wrong inputs application rates, time and other management practices adopted by the farmer's. So, to have a comparative study and to verify farmer's existing practices with moderate improved practices, these management trials were conducted at eight locations in Chitwan district.

DEFINITION OF TREATMENTS

1. Rampur Composite (IV) + 30 kg N/ha. = All side-dressing + behind plough planting, i.e. farmer's method of planting (FMOP),

2. Rampur Composite + 60:30 N:P kg/ha., applied ½ N and all P_2O_5 as a basal dose and remaining ½ N side-dressing + FMOP,

3. Same as treatment number 2 but line planting with the plough alternating two plough passages as a space between the 2 rows, i.e. approximately 75 cm x 25 cm.

4. Same as treatment number 3 but standard line planting plus insecticide, i.e. Sevin application immediately after the pin-holes appears in the young leaves @ 4-7 granules/plant (8-10 kg/ha).

MATERIALS AND METHODS

This trial was conducted at farmer's field in Chitwan district at eight locations but the results were obtained only from two locations. The failure of other six was due to poor plant stand at some locations and birds damage at another place. The plot size was 100 M^2 with single replication at each location. The variety used was Rampur Composite and fertilizer rates its application time were followed as mentioned above. The basal application of fertilizer for the plough planting (FMOP) treatment was broadcasting while for line planting treatment it was localized broadcasting at planting furrow. Side dressing was carried out at 25-30 days after planting. Plants were thinned out where necessary by the farmer as his usual way for the treatment 1, 2 and 3 but for the fourth treatment it was done by the researchers keeping plant to plant spacing 25 cm. These trial were conducted at the upland cropping system with a maize-maize-fallow pattern. For each treatment yield sample was randomly taken from 15 M^2 to 20 M^2 area. Field weights and moisture percentage were recorded and finally yields were adjusted to 15% moisture. For the treatments four insecticide application was not carried out as there were no insect damage noticed.

RESULTS AND DISCUSSION

Table 4 presents the grain yield and other yield contributing component for each two locations. At both the location, Rampur Composite with 60:30 NP

kg/ha; N splitted half as a basal dose and ½ as side-dressing produced the highest yield irrespective of planting method. Treatment 1, Rampur Composite with 30 kg N/ha, applied all as side dressing produced lowest yield. The application of 30:30 NP kg/ha produced 2382 kg more grain and this clearly indicates that the use of at least lower levels of NP are economically feasible. This type of experiment should continue for some years both in summer and winter to draw more informations.

III. Minikit Demonstration

INTRODUCTION

The minikit demonstration program from NMDP was started in 2035 and a large number of minikits were distributed to various districts of the country. Since, Nepal has different agro-ecological regions, so the maize growing season also varies accordingly. With this view the program covers summer, winter and spring minikits.

OBJECTIVES

A) To help farmer to be acquainted with recommended and promising varieties of maize and use of moderate level of inputs,

B) To cover large number of farmers mainly of remote parts of the different districts and to disseminate the seeds from farmer to farmer in shortest possible time.

C) To use the feedback informations from the minikit as a valuable guide to national maize research.

1. Monsoon Minikit

Area : 500 M^2 for each set of minikit

Seed Rate : 1 kg for each set of minikit
(½ kg of one variety + ½ kg of other)

Fertilizer
Dose : 45:0:0 NPK kg/ha
(Urea 5 kg for each set.)

Insecticide: Sevin granule 30 g for each set, whorl application only for borer control.

Booklet : A guide book of planting maize

Feedback Form : Collection of farmers reactions to NMDP.

2. Spring Minikit

Area : 500 M^2 for set of minikit

Seed Rate : 1 kg Arun - 2 for each set

Fertilizer

Dose : 60:30:0 NPK kg/ha for each set

Booklet : 1 copy

Feedback : 1 copy

The seed included in the minikit was treated with fungicide and insecticide to protect against diseases and insects, in a seed drum. Required quantity of seed, fertilizer and Sevin granules were packed in a different size of plastic bags. For monsoon sets, all the plastic packs were again packed in a cloth bag. The spring sets consisted of only seed packed with authorized letter to ADO's to supply required fertilizers and they were asked to send bills for their payment. Monsoon and spring minikits were sent to the district headquarters or regional headquarters hiring Truck by NMDP.

THE FEEDBACK INFORMATIONS FORM

This is a single page minikit information from that was sent to ADO's together with minikit packets, one form is for one minikit set. This form should filled by the farmer who grows minikit and it should jointly signed by minikit growers, field level extension worker who is associated with grower and finally signed by ADO and them send to NMDP, Rampur. The details of form is as below:

1. Farmer's Name .....

   Address .....

2. Date received :

   a) Monsoon .....

   b) Spring .....

3. Varieties included in the minikit:

   a) .....

   b) .....

4. Date of planting .....

5. Date of harvesting .....

6. Yield kg/Ropani:
   a) .....
   b) .....

7. How did you plant the minikit ? .....

8. Is there insects and diseases infestation on field? Yes: ....., No ...

9. Did you apply insecticides ?
   a) What .....
   b) How much .....

10. Rainfall pattern:
   a) High .....
   b) Normal .....
   c) Drought .....

11. What is your feeling if we send minikit with only seed ?
   .....
   .....

12. Do you like variety that are included in minikit ? Yes / No: .....
   a) If yes which one .....

13. How much percentage of yield increase you got from this minikit.....

14. If others, mention .....
   .....

Sign By Cooperator

Sign By JT/JTA

Sign By AD

Date: ...../...../.....

SUMMARY OF FEEDBACK RESULTS

Districtwise minikit distributed during 2040-2041 (1983/1984) are given in Tables 5 to 8 and their feedback informations/reactions received through ADO's are given in Tables 9, 10, 11 and 12. As stated above the feedback informations are very important for the researchers to judge the genotypes and package of practices. But unfortunately, the feedback informations are very poor and unreliable. Following facts were found while evaluating the Feedback Information Form on maize minikit.

A. The percentage of feedback on monsoon and spring minikit is 18 and 9 respectively.

B. Out of 53 districts receiving minikits only 17 were kind enough in sending the feedback.

C. Most of the feedback forms were found without grower's name addresses and other informations that were asked.

D. The grain yield reported on the feedback form were found not sampled yield from the field and it is not with a farmer's years of experiences.

SUGGESTIONS FOR FURTHER IMPROVEMENT

A. Minikit is a means of raising production to some extent. Therefore it should be given to the farmers who work in the field themselves.

B. Do not provide minikit to the same farmer year after year.

C. Do not distribute most of the minikit around the district headquarters only, it should go to remote Panchayats.

D. At the time of distribution of minikit the farmers should briefed about its aim and objectives and what he has to do for its success.

E. The field staff (JT/JTA) are expected to be present at the time of planting, side dressing and harvesting wherever possible and should try to visit minikit plot a several times, and look how the varieties are growing, what they need and make notes on insects diseases problems if the crop is suffering.

F. ADO's are expected to visit at least some of the minikit plots and observe varietal performances, farmer's reaction, the varieties, inputs use etc.

G. The Feedback Information Form should be well read and filled jointly by the farmer's and assigned field staff at the time of harvest.

ACKNOWLEDGEMENT

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Table 1: SUMMARY OF MEAN GRAIN YIELDS, PLANT DENSITIES AND EAR NUMBERS OF DIFFERENT MAIZE GENOTYPES ON FARMER'S FIELD VARIETAL TRIAL IN 1984 SUMMER

Genotypes	KHUMALTAR						KAKANI						KABHRE						Mean Grain Yield Averaged Over All Sites
	1			2			1			2			1			2			
	Yield (Kg/h)	PD*	EN+	Yield (Kg/h)	PD	EN	Yield (Kg/ha)	PD	EN	Yield (Kg/h)	PD	EN	Yield (Kg/ha)	PD	EN	Yield (Kg/ha)	PD	EN	
Manakamana-1	5014	46	41	6077	46	38	3303	45	45	2733	44	47	3740	50	48	3190	47	48	4010
Manakamana-2	5895	45	44	6128	45	44	3506	46	47	3307	49	53	4051	49	47	3349	48	51	4373
Khumal Pahenlo	5748	51	48	5275	51	48	3931	43	48	2854	47	53	3884	50	49	2817	43	46	4085
Farmer's Local	6013	52	53	5634	50	46	4081	44	46	3492	49	55	2178	47	44	2073	47	45	3912
F-test -	NS			NS			NS			NS			*			**			-
CV % -	27			19			10			17			24			8			-
LSD (.05) Kg/ha-	-			-			-			-			1139			1170			-

Notes:

* - PD = Plant Densities,000/ha.

+ - EN = Ear Numbers ,000/ha.

Table 2: SUMMARY OF MEAN GRAIN YIELD AND OTHER CHARACTERISTICS OF MAIZE GENOTYPES TESTED IN 1984 SUMMER

LUMLE AGRICULTURE CENTRE (Altitude: 1465m)

GENOTYPES	Yields (Kg/ha)	Days to 50% Silking	Plant Densities ,000/ha.	Bare Tip Ears %
Arun-1	4309	77	50	17
Arun-2	3708	73	52	7
Arun-4	3199	77	48	7
Manakamana-1	2098	94	52	30
Manakamana-2	3659	90	50	4
Ganesh-2	4099	85	50	13
Amarillo Del Bajio	3456	94	53	7
Khumal Pahenlo	3521	85	49	4
Kakani Pahenlo	3672	94	50	7
Farmer's Local	3459	80	50	4
F-test -	NS			
CV % -	21			

PAKHRIBAS AGRI. CENTRE (Altitude: 5400ft)

GENOTYPES	Yields (Kg/ha)	Days to 50% Silking
Manakamana-1	3416	104
Manakamana-2	2550	98
Hetauda Composite	2225	99
Amarillo Del Bajio	2172	99
F-test -	NS	
CV % -	24	

Table 3: SUMMARY OF MEAN GRAIN YIELDS, PLANT DENSITIES AND EAR NUMBERS OF DIFFERENT MAIZE GENOTYPES ON FARMER'S FIELD VARIETAL TRIAL CONDUCTED AT CHITWAN IN 1984 WINTER

Genotypes	JUTPANI			PANCHKANYA			GUNJA NAGAR 6			GUNJA NAGAR 5			Mean Yld. Averaged Over All Sites
	Yields (Kg/ha)	Plant Densities ,000/ha	Ear Numbers ,000/ha	Yields (Kg/ha)	Plant Densities ,000/ha	Ear Numbers ,000/ha	Yields (Kg/ha)	Plant Densi-ties ,000/h	Ear Num-bers ,000/h	Yield (Kg/ha)	Plant Densi-ties ,000/h	Ear Num-ber ,000/h	
Manakamana-1	4235	43	46	4618	37	40	3166	39	38	2451	38	40	3618
Manakamana-2	5511	39	41	3874	45	49	4106	42	43	3147	37	41	4160
Rampur-1	4810	43	45	4067	39	43	3056	46	48	2704	37	38	3659
Rampur-2	4866	37	41	3261	41	45	3772	42	46	3278	40	44	3794
Rampur Composite	4617	38	39	3272	39	40	4105	50	54	3072	42	41	3767
Farmer's Local	3996	41	42	3393	37	39	3256	41	39	3238	41	44	3471
F-test -	NS			*			NS			NS			
CV % -	17			11			16			16			
LSD (0.05) -	-			773 Kg/ha			-			-			
Date of Planting	041/5/29			041/5/17			041/5/15			041/5/15			
Date of Harvesting	041/10/12			041/9/19			041/9/24			041/9/24			
Cooperator:	P.P. Khanal			S.P. Khanal			S.H. Thapa			D.B. Thapa			
Cooperator's choice:	Manakamana-2			Rampur Composite			Rampur Composite			Rampur Composite			

Table 4: EFFECT OF DIFFERENT MANAGEMENT LEVELS ON THE GRAIN YIELD, PLANT DENSITIES AND EAR NUMBERS ON FARMER'S FIELD MANAGEMENT TRIAL IN CHITWAN 1984 WINTER

Treatments / Locations:	GUNJA NAGAR 4			GUNJA NAGAR 5			Mean Grain Yield Averaged Over Two Sites
	Grain Yield (Kg/ha)	Plant Densities ,000/ha	Ear Numbers ,000/ha	Grain Yield (Kg/h)	Plant Densities ,000/ha	Ear Numbers ,000/h	
1. Rampur Composite (IV) + 30 Kg N/ha all side-dressing + behind plough plant (FMOP)	3288	47	51	3344	40	42	3316
2. Rampur Composite (IV) + 60:30 N:P Kg/h applied ½ N and all P_2O_5 as basal dose + remaining ½ N side-dressing + plough planting	5703	58	65	5692	43	48	5698
3. Rampur Composite + 60:30 N:P Kg/ha as in treatment 2 + line planting with a plough, i.e. alternate plough furrow planting	4773	41	40	3739	44	46	4256
4. Variety + rates and time of N:P application as treatment number 3 + standard method of line planting plus insecticide application when the pin holes appears in the leaves	4953	44	38	5675	46	46	5314

Table : 5

SUMMARY OF MINIKIT DEMONSTRATIONS FEED-BACK INFORMATION, 2040/2041 (1983/84)

Districts	Total Minikit Supplied Spring	Total Minikit Supplied Monsoon	Varieties Included	Average Yield (Kg/ha)	Yield Increased Over Local %	Insects Diseases Inf.* (Yes/No)	Rainfall High (H)	Rainfall Normal (N)	Rainfall Drought (D)	Variety Preferred	Total FBR**
Dhankuta	-	100	Rampur C.+Khumal Pahenlo	1534+1556	30	No	H	-	-	Both	26
	25	-	Arun-2	2400	10	No	-	N	-	-	2
Illam	-	100	Rampur C.+Khumal Pahenlo	1473+1418	25	No	-	N	-	R. C.+	39
Panchthar	-	100	- ditto -	2066+1915	30	No	-	N	-	- do -	94
Khotang	-	100	- ditto -	785+824	20	No	-	N	-	Kh. P.x	64
			Arun-2	1091	40	No	-	N	-	-	7
Bhojpur	-	95	Rampur C.+Khumal Pahenlo	2364+2415	25	No	-	N	-	Kh. P.	84
		5	Mana-1+Khumal Pahenlo	2420+2500	25	Yes	-	N	-		2
	25	-	Arun-2	2692	30	No	-	N	-		25
Sankhuwasabha	-	100	Rampur C.+Khumal Pahenlo	1114+1190	15	Yes	-	N	-	Kh. P.	67
Regional			- ditto -	1556+1553	25	No	-	N	-	- do -	374
			Arun-2	2061	27	No	-	N	-		34
Average			Mana-1+Khumal Pahenlo	2420+2500	25	Yes	-	N	-	Kh. P.	2

* - Inf. = Infestation
** - FBR = Feed-Back Received
+ - R.C. = Rampur Composite
x - Kh.P. = Khumal Pahenlo.

Table 6 SUMMARY OF MINIKIT DEMONSTRATIONS FEED-BACK INFORMATION, 2040/41 (1983/1984)

	Total Minikit Supplied		Total FBR[xx]	Varieties Included	Average Yield (kg/ha)	Yield Increased Over Local%	Insects Diseases Inf.*(Yes/No)	Rainfall			Variety Preferred
	Spring	Monsoon						H+	N++	D^x	
Sindhupal - chowk	-	50	50	Rampur C.+Kh.P.**	1250+1473	40	No	-	N	-	Kh.P.**
Rautahat	-	50	44	- ditto -	981 + 901	25	Yes	-	N	-	Rampur Comp.
	25	-	4	Arun-2	739	20	Yes	-	N	-	-
Chitwan		200	47	Rampur C.+Kh.P.**	1324+1286	25	Yes	-	N	-	Rampur C.
	50	-	6	Arun-2	1200	Same as Local	Yes	-	N	-	-
Makwanpur	-	200	22	Rampur C.+Kh. P.**	1054+1059	10	Yes	-	N	-	Rampur C.@
	25	-	0	Arun-2	-	-	-	-	-	-	-
Ramechhap	-	100	30	Rampur C.+Kh. P.**	1036+ 874	35	Yes	-	N	-	Rampur C.
	25	-	12	Arun-2	1783	30	Yes	-	N	-	-
Regional Average			195	Rampur C.+Kh. P.**	1129+1119	27	Yes	-	N	-	Rampur C.
			22	Arun-2	1241	17	Yes	-	N	-	-

* - Inf. = Infestation
** - Kh.P. = Khumal Pahenlo
\+ - H = High
++ - N = Normal
x - D = Drought
xx - FBR. = Feed-Back Received
@ - Army-worm damage.

Table No. 7

[illegible] INFORMATION, 2040/41 (1983/84)

Districts	Total Supplied Spring	Total Supplied Mons.	Total FBR+	Varieties Included	Average Yield (kg/ha)	Yield Increased Over Local %	Insects Diseases Inf.* (Yes/No)	Rainfall H**	Rainfall N^x	Rainfall D^xx	Varieties Preferred
Tanahun	-	100	35	Rampur C.+Kh. P.++	3570+3607	40	Yes	-	N	-	Both
	50	-	15	Arun-2	3432	35	No	-	N		-
Gorkha	-	180	61	Rampur C.+Kh.P.	3867+3430	50	No	-	N	-	R.C.+++
		5	5	Mana-2+Khumal P.	3580+2900	50	No	-	N	-	Mana-2
		5	3	Mana-1+ " "	5035+4833	50	No	-	N	-	Kh. P.
		10	4	Mana-1+Rampur Comp.	4590+5375	70	No	-	N	-	R.C.
	25	-	0	Arun-2	-	-	-	-	-	-	-
Kaski		75	32	Rampur C.+Kh. P.	3366+3430	47	Yes	-	N	-	Both
			5	Mana-2+Khumal P.	3692+4448	75	No	-	N	-	Kh.P.
	25	-	10	Arun-2	4357	15	No	-	N	-	-
Nawalparasi		200	15	Rampur C.+Kh. P.	633 + 540	10	No	H	-	-	Both
	25	-	7	Arun-2	3200	50	No	-	N	-	-
Regional Average		575	143	Rampur C.+Kh. P.	2864+2752						
	125	-	32	Arun-2	3663						

Table 12:

Dang		100	61	Rampur C.+Kh.P.++	1107+1124	40	No	-	-	D	R.C.
Salyan		60	39	- ditto -	1802+1946	25	No	-	N	-	Kh.P.
Regional Ave.	-	160	100	- ditto -	1455+1535	33					
National Average			812 88	- ditto - Arun-2	1726+1705 2322	30 25	No No	- -	N N	- -	R.C.

Notes: (Common for both the tables)

* - Inf. = Infestation
** - H = High
x - N = Normal
xx - D = Drought
\+ - FBR. = Feed-Back Received
++ - Kh.P. = Khumal Pahenlo
+++- R.C. = Rampur Composite

IADS/KL: ds
January 28, 1985

Integrating Mechanism For Expansion of Foodgrain Production Programs

(with particular emphasis on the Hills)

R.P. Bos*

INTRODUCTION

As integrated part of both the Department of Agriculture and the Agriculture Inputs Corporation (AIC) the Fertilizer and Related Inputs Program (FRIP) attempts to define and assist in the implementation of some integrating mechanism to ensure that the isolated efforts to increase food production are performed in a more coordinated way.

Development formulation generally leads to an assumption that a whole series of changes in methods and conditions have to take place at the same time if full benefit is to be obtained from any one of them.

Experience has shown, however, that the logic of full integration produced its distortions and can not be sustained with the resources available.

On that ground, we focus on determination of the key obstacles or deficiencies, resolution of which would lead many of the other components to fall into place without great public expenditure or external initiative.

MAJOR CONSTRAINTS TO FOODGRAIN PRODUCTION

Although this chapter is not intended to make general statements on the situation of agriculture in Nepal, it is of particular concern that during the last 20 years the yields of the principal cereal crops have declined (2).

The decrease in agricultural productivity of paddy and maize has been most severe in the Mountain and Hill Zones. A growing human and animal population in the Hills is pushing to increasingly cultivation of marginal areas.

Because of de-forestation, erosion has reached an alarming state. Forestry development programs are way behind target. In fact, within the past 15 years,

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only 20,000 ha were afforested while concurrently 2 million hectares were deforested (3). But how to stop deforestation when people are poor and go hungry?

Numerous Hill development projects are being implemented with bilateral and multilateral financial and technical assistance. They are rather characterized by lack of an integrated food production policy and by piecemeal strategy (1).

As a result breakthrough in the productivity of cultivated land of the Hills has not yet been achieved. It is, therefore, no surprise that also institutional and administrative functions related to input supply and marketing in the Hills remain weak or are not put into practice as planned.

The major constraint for increasing foodgrain production in the tarai seems HMG's producer price policy. The rapid growth of wheat output in recent years is presently eroding because farm-gate prices have declined in 1984. In the tarai wheat is predominantly a commercial crop and therefore responsive to price incentives.

FERTILIZER

Fertilizer consumption in Nepal has increased at an average annual rate of about 15 percent from a negligible level of 5000 MT in 1970. Despite the rapid growth, the overall rate of fertilizers application is one of the lowest in the world (9 kg of nutrient per ha).

The low fertilizer input in Nepal is of particular concern to FRIP considering that:

a) agricultural productivity is closely (50 percent) related to soil fertility and fertility management. Any pressure on the traditional agronomic system to produce more yield is bound to produce a net fertilizer deficit and adverse results. There is no question that yields can be significantly increased by judicial and timely applications of mineral fertilizers throughout much of the agricultural land of Nepal.

b) the general relationship used in fertilizer-food conversion is that one ton of fertilizers nutrients produces 10 tons of extra foodgrains. This rule has been confirmed by many fertilizer trials and demonstrations in Nepal and by FRIP in the Hills in particular. The respective reduction in transport volume and cost is evident. Besides,

increased productivity in the Hills would solve a host of other politico-socio-economic problems, which are beyond the scope of our subject.

REASON FOR LOW FERTILIZER CONSUMPTION

a) The low purchasing and repayment power of the Hill farmers attracts major concern. As a matter of fact, many hill families can not sustain themselves throughout the year from their own production at minimum subsistance level. Although it is the primary concern of HMG to bring more food to the hungry people in the Hills, this food is only convenient for those who have the cash to buy. Those who are already hungry will not have money either for food nor for fertilizer.

b) Availability of fertilizer is limited in terms of quantity, timeliness of supply and product type. The Sajhas have virtually monopoly in the distribution of farm inputs and have also been chosen by HMG as an instrument of providing credit to members. Their activities and operational performance records show a steadily deteriorating situation and there is no reason to suppose that this will change in the near future.

c) The multitude of ongoing projects and programs relevant to foodgrain output is confusing. Separate programs have been unable to create an overall strategy which would allow each one to contribute effectively to optimize results.

SUGGESTIONS FOR STRENGTHENING THE AVAILABLE RESOURCES

a) Pocket Development

In the Hills, concentration of financial and manpower resources on production of surplus foodgrain in potential pockets. Elesewhere, low-cost schemes to improve the environmental conditions could be implemented with support by the Food-for-Work Program.

b) Farmers' Group Approach

The group method or block approach has already shown its advantages in some separate programs (ADB/N, HVFP, FRIP, etc.). Extension and supporting services can be managed more efficiently and group action by the farmers improves their bargaining power. Farmer groups may be organized within or without the Sajhas depending on Sajha's willingness and capacity to cooperate.

c) Access to Farm Credit

The experiment of the Small Farmer Development Project in Nepal seems to be the right approach for securing farm credit without collateral to homogeneous voluntary groups. This credit scheme could be expanded with the help of fertilizer donations, for instance through the International Fertilizer Supply Scheme (IFS) (see annex-6).

d) Considering the limitation of the Sajha system in supplying the required farm inputs, it is strongly recommended that HMG allows AIC to increase the number of private outlets.

e) The so-desired linkage between research and extension programs can become a burden on the extension service due to the multitude of dissimilar trials to be conducted in farmers' fields. Therefore, it is very necessary to streamline integration of the two sectors by setting realistic targets. In regard with fertilizer use development, a major contribution towards an uniform program would be the adoption of FRIP's design for simple field trials where fertilizer recommendations do not exist or where existing recommendations need to be refined. There is no need to conduct hundreds of trials if site location is carefully selected with the support of soil-map data or in ongoing production programs.

Similarly, increased fertilizer efficiency demonstrations should be uniform for easy processing. Other related activities to FRIP are symbiotic Nitrogen Fixation (BNF) and improving soil fertility through organic recycling.

Finally, new methods must ensure that the farmer can assimilate them and contribute effectively to better his income and standard of living. For a start, fertilizer recommendations should exclude the application of Compound 20:20:0 on irrigated rice as this type and combination has a low margin of profit. FRIP also suggests that production programs should be based on integrated plant nutrition systems to tap all the sources in a judicious way.

f) The multitude of projects and programs is unfortunately also associated with many separate training programs. A more horizontal training approach

would help in avoiding the problems of coordination and ensure that conflicting messages do not go to the farmers.

g) The above mentioned suggestions call for normal organizational linkages between research and extension and a harmonization of technical and financial assistance projects at national level. Formal or informal meetings of project managers and staff of comparable schemes should be held to avoid repetitions of failures and to optimize results (1).

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2. Handbook of Agricultural Statistics of Nepal.

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A Review of Rice and Maize Seed Multiplication Program And Their Distribution in the Year 1983/'84

Uptil now Agriculture Inputs Corporation is the only organization involved and engaged in seed production, procurement and distribution of improved and certified seeds in Nepal. Though seed business constitutes a very small part of the total volume of transactions of AIC, the rate of seed quantity is more important than other complementary inputs. AIC used to handle the seed business of major cereals like Rice, Maize, Wheat and some vegetable seeds with its limited technical manpower and now it is also made responsible to look after the groundnut seed production and also some of the grasses with the same existing manpower, which is to be realized by the management of AIC.

A review of statistics of seed sales through an institutional source for the last 10 years shows that the average sales of paddy and maize seeds are 320 and 139 MT, respectively, (Table 7). AIC sold about 289 and 170 MT of rice and maize seeds last year which would cover 0.47 percent and 1.6 percent of the total area under paddy and maize respectively. Even with the direct involvement of some of the agricultural projects and a supplementary role being played by the government farms in the dissemination of improved seeds, the total hectarage covered by improved seed looks still unsatisfactory.

SEED MULTIPLICATION

Table numbers 4 and 5 show seed multiplication program target and achievements of paddy and maize seeds, respectively, for the Fiscal Year 1983/84 and also indicates the proposed multiplication program for the F.Y. 1984/85 for both the crops. In case of maize the varieties included for multiplication were mainly Arun, Rampur Composite and Khumal Yellow and in case of paddy mostly all the released and recommended varieties were taken into considerations. Due to lot of different reasons the maize seed multiplication program was not upto the target and collection also. Chitwan district was the major area for variety Arun. About 40 metric tons of Arun maize was collected from Chitwan and the quality was good at the time of collection, which was in the month of September/October 1983/84.

During 3 months storage period germination was found dropped. Other varieties Rampur Composite and Khumal Yellow seeds are stored now in Kathmandu and Daman to avoid high heat and high humidity of terai. Recent check on germination capacity of Rampur Composite and Khumal maize seeds has shown that the seeds are in good conditions, so AIC has started despatching those seeds to different districts for summer plantation. Out of the proposed targets of 400 hectares (Table 5) about 200 hectares have been planted under winter maize program in Chitwan, Bara, Parsa, Dhanusha and Mahottari districts and other 200 hectares will be used for summer plantation. The area under seed multiplication of paddy in the government farms and AIC, is shown, respectively, in Table 3 and Table 4. The table 4 shows that regarding paddy seed multiplication of AIC the achievement looks lesser than the targeted area. But if we look back in our past ten years sales record of paddy seeds, the quantity collected from both government farms and contracted farmers should be enough for fulfilling the farmers demand for paddy seeds in the whole country.

COLLECTION AND SALE OF MAIZE AND PADDY SEEDS

The sales record of improved maize and paddy seeds through institutional levelsis rather discouraging (Table 7). The Figures on Tables 1, 2 and 7 indicates that the average amount sale of maize and paddy seed through AIC during the last 10 years been only 139 and 320 MT respectively. This clearly shows that the maize and paddy seeds collected by AIC was adequate enough to meet the existing demand of the farmers. Besides the popular farmer to farmer diffusion, other common reasons attributed to the poor sale of maize and paddy seeds are the poor quality and high cost of seeds produced by AIC. However, it should be kept in mind that seed quality standards of a country should be judged against the available technology and infrastructures. Still more, it could be said safely that the seed produced and distributed by AIC are of much better quality than the ordinary seeds that farmers are using, in genetic as well as in all other seed quality considerations. A careful analysis of cause would reveal that there is still lack of seed consciousness in Nepalese farmers and this could be the reason why our farmers are more conscious of seed price.

PROBLEMS

1. Although the problems and constraints being faced by the seed program has been discussed time and again during various meeting/seminars etc. efforts

to solve those have not yet been made as desired. However, few important problems are once again given below:

i) The unavailability of required quantity of source or foundation seed from the concerned crop coordination program

ii) As compared to the increasing area under seed multiplication program every year, the technical manpower both in Seed Technology and Improvement Program (STIP) and AIC looks insufficient for farmers field to be inspected timely. Moreover, there is very limited mobility available for field inspection work.

iii) Lack of well equipped seed storage facility.

iv) Lack of legal procedures for seed business.

v) Nationwide bottlenecks for selling improved seeds have been associated with the retailers may be because of lack of fund or may be due to the commission they get out of selling seeds.

vi) Seed business in Nepal is always dependent upon various levie agencies which at any level needs perfect coordination resulting into a mass adoption of improved seed by farmers.

vii) The demand forcasting for the improved seed has become a traditional barrier which many time does not tally with the real consumers' need.

Table 1: Regionwise Paddy and Maize Seed Sales of AIC in F.Y. 1983/1984

Regions	Paddy	Maize
Eastern Region	73.216	34.525
Central Region	56.716	93.071
Western Region	50.480	34.074
Mid-Western Region	90.998	5.925
Far-Western Region	17.147	2.171
Total :	288.457	169.766

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Table 2: Regionwise Paddy and Maize Seed Collection in F.Y. 1983/1984

Regions	Paddy	Maize
Eastern Region	292.000	20.000
Central Region	443.345	345.000
Western Region	133.800	15,000
Mid-Western Region	81.000	23.000
Far-Western Region	21.000	11.000
Total :	971.145	414.000

****

Table 3: Paddy Seed Multiplication Program in Government Farms and Stations in F.Y. 1983/84

S.No.	Name of the Farms/Stations	Target Area in ha.
1.	Khumaltar Agri. Farm	3.05
2.	Khajura Agriculture Farm	11.1
3.	Bhairahwa Agri. Farm	15.7
4.	Surkhet Agri. Farm	8.0
5.	Kankai Farm	10.0
6.	Doti Agri. Farm	2.0
7.	Parwanipur Farm	13.9
8.	Hardinath Farm	36.2
9.	Jiri Agri. Centre	4.5
10.	Jhumka Farm	47.0
11.	Tarahara Farm	22.0
12.	Rampur Agri. Farm	13.5
	Total :	184.95

Table 4: Paddy Seed Multiplication Program Target and Achievements of AIC in F.Y. 1983 / 1984

S.No.	Name of Office	Target (ha)	Achievements (ha)	Proposed for F.Y.'84/85
1.	Biratnagar	50	50	50
2.	Itahari	50	-	50
3.	Kathmandu	10	10	20
4.	Birganj	50	40	-
5.	Bharatpur	50	50	-
6.	Bhairahwa	50	41	50
7.	Nepalgunj	25	21	30
8.	Janakpur	100	100	200
9.	Mahendranagar	-	7	-
10.	Dhangadhi	20	7	-
	Total Area :	400	326	400

(Included in the above proposed paddy seed multiplication program in F.Y. 1984/1985 is the seed multiplication program of AIC/SPIS Project in the 20 mid-hill sites).**

Note: Of the two seed projects affiliated with AIC, AIC/CSPP Project concentrates its efforts in seed multiplication, processing, distribution and marketing in tarai and AIC/SPISP in the hills.

Table 5: Maize Seed Multiplication Program Target and Achievements of AIC in F.Y. 1983/84

S.No.	Name of Office	Targets (ha)	Achievements (ha)	Proposed Target for F.Y. 1984/85
1.	Biratnagar	50	-	230
2.	Chitwan	225	225	-
3.	Bara and Parsa	300	140	100
4.	Janakpur	50	50	25
5.	Parasi	75	25	25
6.	Bhairahwa	20	10	-
7.	Dang	20	20	20
	Total Area :	740	470	400

(Included in the above proposed paddy seed multiplication program in F.Y.1984/1985 is the seed multiplication program of AIC/SPIS Project in the 20 mid-hill sites.)

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Table 6: AIC Regionwise Sales Target of Paddy and Maize Seed in Fiscal Year 1984/1985. (Quantity in M/Ton.)

S.No.	Name of Regions	Maize	Paddy
1.	Eastern Region	158	627
2.	Central Region	182	273
3.	Western Region	160	139
4.	Mid-Western Region	58	78
5.	Far-Western Region	33	83
	Total :	591	1200

****

Table 7: Sales of Maize and Rice Seed AIC

S.No.	Year	Quantity of Seed Sold	
		Rice	Maize
1.	1974/1975	328.000	51.000
2.	1975/1976	184.000	145.000
3.	1976/1977	359.000	106.000
4.	1977/1978	299.000	145.000
5.	1978/1979	255.000	93.000
6.	1979/1980	305.000	149.000
7.	1980/1981	205.000	104.000
8.	1981/1982	244.000	135.000
9.	1982/1983	725.000	288.000
10.	1983/1984	289.000	170.000

Discussion on AIC Seed Multiplication Program

Y.K. Dahal : Please comment on Arun Maize Seed Disaster of 1984. Who is responsible ? AIC or farmer ?

Yadav : We could not distribute the Arun seeds in desired quantity, because of the poor germination of seed in godown so AIC is responsible.

K.P. Upadhyaya : Mr. Yadav, you have enumerated several problems being faced in connection with seed business. Is not lack of incentive price to the seed growing farmers really a problem in getting quality seeds from the farmers ? Thank you,

Yadav : The price which we are providing to the farmers is sufficient to get the quality seeds if we supervise regularly and in time.

Dr. K.D. Sayre : Please describe the problem involving the poor germination of AIC supplied Arun seed last year. If the low germination was known before distribution, why was it distributed ? If it was not known to be poor in germination before distribution then why not ?

Yadav : In last year, we collected the Arun seeds from Chitwan district seed growers in good condition, but we could not process and dried the seed in time. So the germination became low. But before selling we advised to increase the seed rate as the germination percentage was low.

The Cereal Seed Production Project (CSPP)
Its Objectives and Its Role in Nepals Seed Supply

Dr. W. Rothhaar*

1. GENERAL SURVEY OF THE PROJECT

The German Agency for Technical Cooperation (GTZ) has recognized the vital role of seed production in Agricultural Development in developing countries, the same also in the kingdom of Nepal.

It is granted, that seed improvement is one of the most important factors to increase food production in quantity as well as in quality. It also has a wide range of beneficial effects on the economy as well as on the social pattern of a country:

- increase of agricultural output
- decrease of food imports and seeds - and in this way saving foreign currency
- improvement of nutritional status
- increase of farmer's income
- promotion of jobs
- however, the use of better seed requires better agricultural methods and improves the knowledge of the farmers.

According to the Agreement between the Nepal and German Governments the installed GTZ - Project is working with AIC - Seed Division and their appending offices, Seed Processing Plants and HM - Institutions.

The project provides 2 German GTZ Experts: one, Project Teamleader at AIC Head Office, Kathmandu, one Seed Technologist at Hetauda Seed Plant and one Scientific Researcher, for research work on the economy of cereal seed production. Also two volunteers from the German Volunteer Service (GVS), one electrician and one mechanic assist the Project, on the technical side. They are taking care of maintenance and also repairing of the engines and machineries as well as the electric installations of the Seed Plant. Besides this, they are also giving training in the same fields as already mentioned.

* Project Teamleader.

2. BACKGROUND OF THE PROJECT (brief history of Seed Production in Nepal)

In the past 15 years, efforts have been made to implement a viable Seed Industry in the country by a number of bi-lateral and multi-lateral assisted studies and programs, some of them may be described as follows:

A. Increased use of high yielding crop varieties (UNDP-FAO sponsored) operations started in 1970, terminating in 1976, providing a Seed Plant in Hetauda, one of the main seed processing facilities in the tarai.

B. Also USAID has sponsored different seed programs in the following years up to today as for instance:

1. Mississippi State University Consultation
2. Integrated Cereals Project (ICP)
3. Seed Production and Input Storage Project, (SPISP) both are still operating at present.

While the ICP is aiming at making available adapted high yielding cereal varieties suitable for different eco-systems, the SPIS Project focuses on multiplication, storage, transport and distribution of improved varieties and necessary complementary inputs to the more remote areas (hills) of Nepal.

C. Under German Technical Assistance (GTZ)

Seed handling equipment has been supplied already in 1978 in the main Seed Plants in the Tarai besides Hetauda, Bhairahwa, Itahari, Janakpur and Nepalgunj. As the future of the Cereal-Seed Programs in the country had been reviewed and a conclusion had been drawn that the German assistance in seed multiplication should be continued also in the coming years. Proposals for the extension of the initiated program had been made and the agreement in the new : Cereal Seed Production Project (CSPP) was signed by both the Government of Nepal and the Federal Republic of Germany in 1983. The Project then started the same year, attached to AIC-Seed Division, operating on seed production, processing, storing and marketing in the Plains of the tarai.

3. MAIN AIMS AND ACTIVITIES OF THE PROJECT

A. Assistance in production of cereal seeds (wheat, maize and rice) from breeders seed up to certified seed including organization of seed multiplication with seed growers.

B. Supporting the Botany Division in seed certification, testing and utilization of seed labs.

C. Supervising seed processing and storing in Seed Plants

D. Advising extension service in their field work

E. Investigation of Seed demand of the seed users in the country

F. Investigation of sorts of seed production, processing and marketing

G. Supply necessary seed processing equipment and vehicles

H. Conducting training courses, seminars and on-the-job-training of counterpart staff in the field of seed production, processing, storage and marketing within AIC and other institutions concerned.

4. PROVISION OF SCHOLARSHIPS, OBSERVATION AND STUDY JOURNEYS FOR COUNTERPART STAFF

5. COORDINATION OF PROJECT AND AIC-ACTIVITIES WITH DIFFERENT GOVERNMENT OFFICES ORGANIZATIONS AND FOREIGN AGENCIES IN THE FIELD OF SEED PRODUCTION

6. PROJECT STRATEGY

In oder to prepare an effective plan of operation a work-shop seminar on Goal Oriented Project Planning (GOPP) has been held last year in June. Besides the Operational Plan, the following Project Strategy has been formed:

Project Objectives

Out of several alternatives the CSPF has developed a strategy with the objective TO IMPROVE THE PRODUCTION, PROCESSING AND MARKETING LINE OF CERTIFIED SEED in a defined project area. The main objectives to achieve this are:

A. Communication and coordination within AIC and in between concerned agencies ensured;

B. Project training program established; number of trained manpower on all levels increased;

C. Production of certified seed improved and losses on farmer's level minimized;

D. AIC-extension service for seed growers effective;

E. Cooperation with DOA-extension service improved;

F. STIP-activities supported and improved;

G. Storage and processing system of AIC improved and losses during storage and processing minimized;

H. Internal seed quality control at all stages of seed production effective;

I. Effective seed demand forecasting system in operation;

J. SAJHAS supported and more effective;

K. Alternative seed marketing concept suggested and tested.

Considering the resources available to the project it is necessary to concentrate the activities to a limited area in order to be able to achieve these objectives. The CSIP will, therefore, concentrate its work in a pilot area of three cereals seed production areas comprising of nine districts in Narayani, Lumbini and Janakpur Zones: Bara, Parsa, Makwanpur, Chitwan, Parasi, Rupandehi, Kapilvastu, Mahottari, Dhanusha. However, other areas of the tarai will be supported by the project and involved in different programs, such as the training program and the maintenance program for seed processing facilities.

7. PROSPECTS AND DESIRES

According to the GOP, the Project must be integrated in the national seed multiplication on all levels. Therefore, coordination as already mentioned with all institutions in the country is of most importance. Myself and my co-workers as well as my counterpart would be grateful for the kind assistance

and support of all seed concerned institutions in the country, especially the cereal breeders and government seed farms as well as all other organizations and foreign agencies. For this reason, I will always welcome the opportunity to meet each other for discussion and exchanges of experiences in the field of seed breeding, production and so for the benefit of the farmers and last but not least for the people of this country.

Discussion On The Cereal Seed Production Project (CSPP)

Dr. K.D. Sayre : When will grain legume seed production become included in AIC's Program ?

Dr. Rothhaar : It will be included in second phase.

J.P. Tamulonis : In your main objectives of CSPP you mentioned that you will assist in the production of rice, maize and wheat seed from breeders seed to certified seed. Considering millet covers at least 125,000 ha in Nepal, do you have any plans for assistance in the production of this important but neglected hill food crop ? Please comment.

Dr. Rothhaar : It will be included in the second phase.