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FARMING SYSTEMS RESEARCH PROGRAMME

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USAID / MART / PARC

DEPARTMENT OF LIVESTOCK MANAGEMENT
UNIVERSITY OF AGRICULTURE, FAISALABAD.

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SMALL HOLDING LIVESTOCK AND FODDER PRODUCTION/PRESERVATION PROGRAMME SHAHKOT/PROKA/LALIAN/JHANG/ PINDI BHATTIAN/GOJRA/NAROWAL

PROGRESS REPORT
1992 - 1993

By

Dr.Raza Ali Gill
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DEPARTMENT OF

LIVESTOCK MANAGEMENT

UNIVERSITY OF AGRICULTURE

FAISALABAD

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TITLE OF THE PROJECT:

SMALL HOLDING LIVESTOCK AND FODDER PRODUCTION/PRESERVATION PROGRAMME

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TARGET AREAS:

SHAHKOT	PROKA
LALIAN	JHANG
PINDI BHATTIAN	NAROWAL DISTT. &
GOJRA	

COMPONENT UNITS:

Coordinating Unit
Livestock Management
Agronomy
Parasitology
Animal Reproduction
Agricultural Economics

EXECUTIVE SUMMARY

Main objective to initiate this project was to study the farming system as a whole by applying an integrated approach to on-farm crop livestock research through farmer participation. Keeping in view the objectives of FSR project in the target areas, priority constraints were identified and on the basis of diagnosed problems several experiments were conducted using farmers limited resources.

The major constraints of livestock production were feed shortage, mineral deficiencies, worm infestations and low market incentives for products. Farmer validated technologies were transferred by using extension media on mass scale in both the areas.

For improving the fodder availability improved seeds of berseem, lucern and a miraculous multicut fodder (MOTT) was introduced and tested. The combined extra green fodder produced by these fodder cultivars especially by Mott grass gave participant farmers a triple fodder intervention pay off. Feed and mineral supplementation trials were conducted to study the production performance of heifers and lactating buffaloes. Results indicated significant improvement in the growth, sexual maturity, calving interval and conception rate. Deworming experiments were conducted to demonstrate and to test the effect on growth performance of sheep, goats and youngstock. Fodder trees/grasses were also introduced to improve the availability and ultimately enhanced production.

During the year 1992-93 several farmers were involved in various activities as under:

Treatment of straws	200
Fodder Production	7845
Fodder Preservation	96
Feed and Mineral Feeding	545
Deworming/Vaccination	2623
Fodder Trees/grasses Plantation	50
Training Courses/Field Days	30
Post graduate Research	2
Video's for Production	1

All these efforts resulted into improved fodder availability, increased animal production, improved body condition, decreased parasitic infestation/disease incidence, early sexual maturity, trained farmers and increased farmer income.

Training of farmers and field staff regarding treatment and production of animals were undertaken successfully. About thirty field/training courses were offered including one course on women's participation in income generation activities through poultry rearing and marketing.

Post-graduate research was sponsored by FSR Component and focused on on-farm research for validation including two Master's degree students.

Fact sheets and video's were prepared in collaboration with NARC audio-video centre, Islamabad.

Budget allocations for small holding livestock and fodder production/preservation programme component University of Agriculture, Faisalabad were Rs. 2,92,550.00.

INTRODUCTION

There has been a gradual increase in livestock products such as milk, beef, mutton, poultry meat and eggs over the years, still the per capita availability is reported to be far below when compared with the developed countries of the world.

After independence several new institutions and organizations were created to under take research in Livestock and Agriculture Sectors. The productivity in agriculture sector increased tremendously and the country attained self sufficiency in food. Surplus production in rice, cotton etc. also resulted.

The livestock sector is an important component of the agricultural economy in Pakistan. Its primary purpose is to meet basic dietary and work requirements. The generation of cash income is a second objective. The herd size is small, livestock production primarily involves the small farmers for whom it is a marginal enterprise at best. A change from subsistance mode of production to commercialization is needed.

The contribution of livestock to value added in the agriculture sector is around 30 per cent equivalent to 8 per cent of GDP. The activities of this sub sector account for 10 to 25 of the incomes of small farmers and landless livestock producers depending on the accessibility of the market.

It is estimated that the green fodder availability is about 40 % less than the requirements of our animals. Even the dry roughage situation shows a deficiency of about 19.0 per cent.

There will be a big challenge to Pakistani farmers to cope with the alarming situation. This, of course, would depend how well the National Agricultural Research Systems would provide new and usable technologies to the farmers to meet the challenge. Furthermore, if the solutions are sought, and these remain confined in the laboratories of the research institutes and in the note books of the researchers, these are of no use to the farmers and to the nation.

Hence, there should be a continuous flow of informations from and to the farmers.

Several institutes are available for research, training and extension work with good working efficiency. Pakistan is well equiped with trained manpower having best knowledge and ability to tackle all aspects of crop-livestock production from various internationally known universities. Inspite of all these extended research, training,extension facilities and well trained/qualified manpower, farmers are not able to get optimum benefits from these and as a result, our productivity is far below the developed countries. No doubt we are lacking some facilities but there is some thing more missing in our system which is biggest hindering stone in our way to progress in the area of agricultural productivity.

Funding to the agricultural sector is far less than its contribution to GDP. It is more so in case of livestock sector which is particularly neglected.

The farming system research is a new approach to improve the socio-economic status of the small farmers. Unlike conventional research, it involve both the farmer and scientists. They become partners in problem identification and solving. The technology relevant to the existing conditions is generated and validated under farmers conditions. Therefore, it can easily be adopted by the farmers communities. Since, whole of the farming system at site is involved it is different to commodity or single component research programme.

Farming Systems Research (FSR) project was started in with the aim to develop technologies appropriate to farmer circumstances. The most pressing aspect of the need for agricultural research in Pakistan is meeting the needs of its rapidly expanding

population. Our present population of 103.8 million is growing at 3 % a year one of the fastest population growth rates in the world. The population will reach almost 140 million by the turn of the century. So providing even the current amount of food per person will require a production increase of at least 40 % over the next 8 to 10 years.

In Punjab, University of Agriculture, Faisalabad and Ayub Agriculture Research Institute, Faisalabad are taking FSR work. After the completion of formal and informal survey several constraints were identified

CONSTRAINTS:

1. **Scarcity of resources for inputs.**
2. **Marketing system inadequate.**
3. **Land holding are very small.**
4. **Out moded fodder varieties.**
5. **Poor feed resources and thus the productivity of animals is low (late sexual maturity, very long calving interval).**
6. **Shortage of canal water, and poor water management.**
7. **Low productive animals and lack of veterinary support.**
8. **Parasitic (Endo/Ectoparasites) infestation in small ruminants.**

Keeping in view the formal and informal contraints and previous field work indicated the solution of certain priority contraints by conducting on-farm and on-station research.

These observations have encouraged the testing of improved feeding and animal health management to improve farming productivity in FSR target areas.Following interventions were proposed in the annual work plan for experimentation and mass scale dissamination.

INTERVENTIONS/OBJECTIVES:

1. Fodder Production through improved fodder varieties. and agronomic practices.
2. Enrichment and preservation of crop residues/straws and surplus fodder.
3. Introduction of multipurpose trees/grasses
4. Feed and mineral supplementation
5. Deworming/Vaccination of animals.
6. Research and training .

The FSR programme is now old enough to review some of the earlier results. It has been observed that some of the interventions validated at the farmers field can be introduced on large scale.

Field demonstration plots were set up at several new sites (Proka, Shahkot, Gojra, Lalian, Jhang, Pindi Bhattian and Narowal Districts). These were coupled with field days at appropriate time where scientist and farmers work together.

Farmers training in straw treatment, silage/hay making, use of agro-industrial waste products (citrus pulp, molasses, baggasse, press mud) were taken up on an extended level.

These contact farmers were taken as demonstration units and neighbouring farmers were invited and convinced of the benefits of the interventions by field days and observing significantly better performance of animals. For pilot to production phase, several departments and Non-Government agencies were involved.

All the inputs used for interventions/demonstrations were partially obtained from the farmers to ensure sustainability of the interventions demonstrated. It was properly managed and ensured to be available at cheaper rate and easily all the time. It was further ensured that all the inputs were made available at reasonable rates.

Several below listed institutions/departments/NGO's/other agencies were involved in this course of time.

1- Livestock and Dairy Development Department

2- Livestock Production Extension Project.

3- Agriculture Extension Department.

4- Cargill Citrus Sargodha.

5- Milkpak Ltd.

6- Feed and Seed Companies.

7- Medicine Companies.

8- Non-Government-Organizations

9- IFAD Project, Gujranwala.

FODDER PRODUCTION

Livestock production is badly affected due to certain reasons; lack of awareness to production practices, scarce fodder resources especially during severe winter and summer season and low yield potential of existing fodder crops. The range land constitutes single largest grazing land use in Pakistan. The feed balance sheet reveals that our animals suffer both from energy and protein deficiency by 40 and 60 per cent, respectively. Interms of roughages our animals are getting about 40 per cent less green fodder than what they require.

Human population pressure will not permit to allocate more area for fodder production and also due to competition with cash crops urgently needed to feed humen population. Hence vertical expansion in the area for fodder production is impossible. Horizantal expansion i.e.,increasing the fodder productivity per unit area, using non-conventional fodder sources and growing and using fodder species on soils which otherwise are not suitable for cash crop production may leave a ray of light to continue livestock production.

Experiments have shown that cow and buffalo can yield more on an average 25 per cent more milk as a result of better feeding and management. The single factor in the production cost of milk is feed, which is 60-70 per cent of the total cost of milk. To get more production, dairy animals must be fed with nutritionally balance feed rich in energy, proteins, vitamins and minerals and water to make up for deficiencies caused to animals in the process of giving milk.

A very serious constraint that continuously hampers improved and increased fodder production is lack of seed availability of superior high yielding varieties and the poor quality of farmer saved seeds sold on the local market.

On small farmers 14 to 25 percent of the land area has to be allocated to fodder production. The empirical evidence and baseline surveys indicated that inspite of that fair allocation by resource

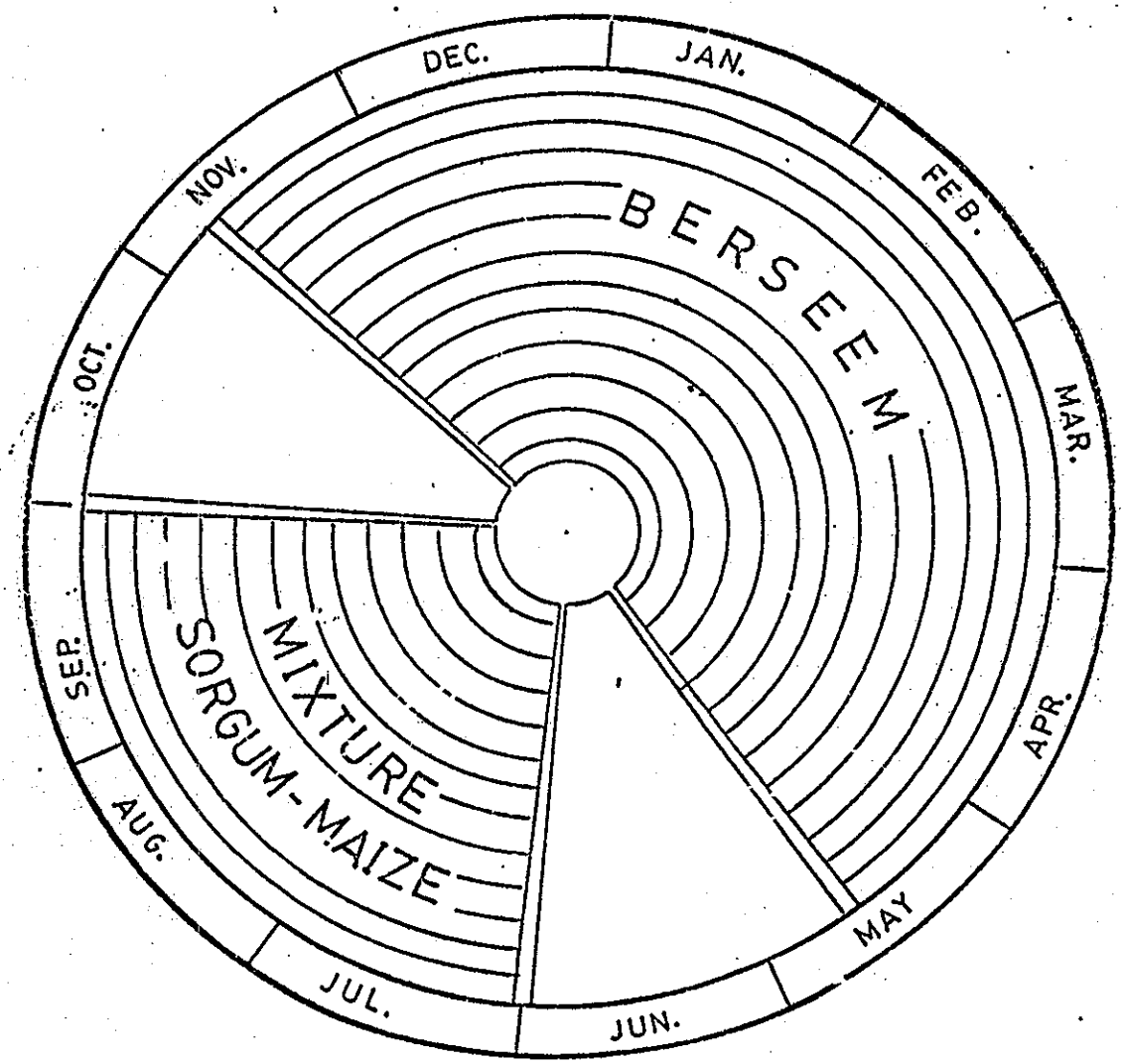
scarce farmers, the livestock is inadequately fed.

Successful introduction of multicut summer fodders have resulted into

1. Better feeding with nutritious feed throughout summer
2. Yield increases and possibilities of reducing fodder area as well as saving scarce inputs for other crop production programmes
3. Better animal productivity
4. Conversion into silage possible through enhanced yields.

Two seasonal fodder shortages (May-June and Nov-December) can be removed by changing the pattern of fodder production (Fig-1). The conventional fodder crops such as maize and sorghum require at least two plantings during summer. Apart from input costs (land preparation, seed, fertilizer etc) there is always a high risk of crop failure. Monsoon rains and insects/weed infestation are contributing factors. Sudex (Sorghum X Sudan grass) was introduced (in March). The first cut is available in May-the shortage period. The fodder is very palatable, high yielding and covers the crunch period (Table-1).

Earlier on-station and field research work and data indicated that fodder crop production can be increased by 40 to 150 per cent. In Pakistan traditional feeding methods are still used for livestock production. Large ruminants are raised on farm grown fodders and crop residues. In canal irrigated areas of the country fodders are seasonlly grown. Some more nutritious fodders like legumes are cultivated in winter (Rabi season), whereas most cereal fodders are available in summer (Kharif season). The chemical and nutrient composition of green fodders are variable and depends on the species, stage of growth, soil condition, fertilizer application, availability of water, climatic conditions, etc. Under optimum agronomic stages of growth i.e.,the optimum stage of cutting.



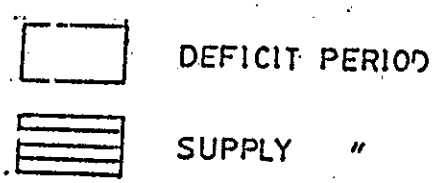


Fig. 1. Seasonal feed supply under conventional fodder system.

Table- 1. Facing The Crunch Periods through Sadabahar.

	Improved practice (S.S. Hybrid)	Farmer practice (Maize Sarghum)
Fresh matter yield(t/ha)		
Site 1	143.00	85.90
Site 2	140.25	85.40
Site 3	142.65	65.85
Site 4	144.94	61.68
Site 5	139.88	70.63
Average	142.14	73.88
Partial Budgeting.		
* Av. fresh matter yield	142.14	73.88
* Adjusted yield(t/ha)	127.93	66.49
* Variable costs(Rs/ha)		
* Cost of seed	440.00	600.00
* Cost of land preparation	395.00	790.00
* Cost of sowing	148.00	494.00
* Cost of Fertilizer	1645.00	786.00
* Labour for hoeing	210.00	
* Labour to apply fert.	72.00	36.00
Total:	9210.00	2706.00
* Percent increase in variable cost (Rs/ha)	7.46	
* % increase in fodder	92.40	

Picture- 1. Plantation material of Mott grass is being taken for distribution to other sites this includes mostly cuttings and some time root-stock.

During Rabi season improved seeds of Berseem and Lucerne were introduced and production was compared with farmer practice.
In the target areas a clear cut on-farm demonstrations were carried out at several small farmers sites using partially the project resources under this programme. In the adjacent fields, an excellent stand, relatively weed free and highly productive planting of Berseem using good quality seeds and on the other side (farmer practice) a very poor irregular stand, excessively weedy and much less productive planting of Berseem using low quality farmer produced seed source. This simple comparison has effectively convinced the farmers of the value of improved seeds, but the problem is availability of better seeds at proper time of the season.

To overcome the 40 per cent deficit situation of green fodder, strategies for replacing the fodder varieties which are more productive and available throughout the year.

MOTT a miraculous fodder crop gives better yield and is perennial remain for years in the field and reduces the cost of seed and resowing expenditures. MOTT is one of the more potential fodder varities. It was originally selected in 1977 at Tifton, Georgia by Dr. Wyne Hana and associates from among the selfed progeny of "Merkeron" a tall hybrid selected from a dwarf X tall napiergrass crose made by Dr. Glenn W.Burton in 1941. The USDA-ARS and the University of Georgia coastal plain experimental station jointly released the selection as Tifton N75 .

Dr Gerald O.Mott, Proffessor of forage and pasture management, and his associates introduced animal trials; Dr. Mott reported at an American Society of Agronomy meeting that 2 lb per day liveweight gains with beef cattle that they had achieved in North Florida. Dr. Mott was the first President of American Society for crop Science. Because of his outstanding accomplishments and leadership and

his research efforts with dwarf elephant grass, his Colleagues at the University of Florida deemed it apporopriate to name this cultivar "Mott".

In Pakistan, it is also known as "Dudh ka kamad" and would like to request that rather than calling it Mott napiergrass or Mott elephant grass, it is so that there may be no confusion with highly productive Mott dudh ka kamad.

Results of several plots of Mott grass sown at Livestock experiment station University of Agriculture, Faisalabad .The plot was prepared and by applying all requisits like FYM, Phosphatic fertilizer at the rate of 1 bag DAP or 2 bags NP per acre, and thoroughly tilling the soil as for wheat planting. Then it was weekly irrigated.

An experiment was conducted to test the seasonal effect on sprouting and germination of Mott (Table-2). Data revealed that severe winter reduces the germination/sprouting of Mott Plants.

In another experiment the Mott cuttings were sown in the plot in Novemeber, 1992. The oats and berseem were also inter cropped in the area and the first cutting was taken in the start of April, 1993. The data of the 2nd cutting was being started from 8th June.

i. No. of tillers per plant.
ii. The average height or growth rate per week of the plant.
iii- Weight of the plant at the cutting or harvesting stage.
iv- The total number of plants was also noted.

The average growth of plants per week was observed. The avg. height, number of tillers and weight per plant was taken(Table- 3).

The production may be increased by using more care and intentionally managing the Mott and by filling up the gaps after each or Ist cutting purticularly. Continuous irrigation also effects the production. The Mott grass was cut at interval of 8 weeks, which may be decreased or increased with some variation in quality and quantity of Mott (Dudh ka kamad).

Taukumi Izuno, the poineer for Mott introduction in Pakistan recommended that it is good for continuous supply on a 45 day cutting

interval. The quality which is higher at 35 day interval and quantity which much higher at 70 day intervals. Izuno also reported the digestibility of Mott grass on his trials on beef cattle i.e., leaves are 75 % digestible and stalks are 58 % . On overall basis the leaves were having about 13.5 % crude protein. The production is better by fertilizing with FYM and 1 bag urea after harvest and irrigating regularly.

After the November cutting, it is decided to add a bag of DAP in their two year old planting, 45 day growth of clumps growing at 1m & 1m spacing was 25 kg per clump. The per acre yield was 100 tons in one cutting. No one would believe such a yield. We would have expected a total of 192 tons of green forage in 5-6 cuttings during a year (Table- 4).

The fodder gave excellent results when tested at the University Research Station. If managed properly it persists for many years. It has excellent drought tolerance. The forage quality is excellent which is even maintained at different stages of maturity. The establishment (vegetative) is very easy under most of the irrigated tracts in the country. Production performance of Mott is better than all other Kharif fodders . The palatability is excellent and different ruminants like the fodder (Table- 5). Fodder availability situation has been improved by the introduction of improved seeds/cultivars and agronomic practices (Fig- 2).

So keeping in view all these facts and figures it is immensely needed and boldly recommended to be extended on large scale to the small farmers, furthermore, a farmer can raise economically a unit of seven dairy animals on one acre of Mott field very easily (Table- 6). With the help of God Allmighty we have been able to distribute Mott Technology at several sites in more than 32 districts throughout the country (Fig- 3).

Table- 2. EFFECT OF SEASON ON SPROUTING AND PERFORMANCE OF MOTT

	Sowing Date	Germination (Percent)
Plot-1	07-10-92	90
Plot-2	22-10-92	94
Plot-3	04-11-92	44
Plot-4	19-11-92	30
	Average	64.5

INTERCROPPING WITH BERSEEM

Cutting	Tons/acre
First cutting	12.800
Second	12.000
Third	11.520
Total	36.320

INTERCROPPING WITH MAIZE

Crop	Tons/Acre
Mott	32.6
Maize +Mott	53.2

Picture- 2. Mott grass is being planted at a distance of 3*3 feet in lines. Line to line distance would also be same (3*3). A rope can be used to keep the lines straight this is necessary for future hoeing and other operations.

Table- 3. VARIOUS PRODUCTION PARAMETERS OF MOTT.

Plant No.	Height (Feet)	Tillers No.	Weight/Plant (Kgs.)
1	4.3	11	5.5
2	4.9	09	5.0
3	3.5	08	5.0
4	3.1	17	6.0
5	3.4	06	3.0
6	5.3	16	5.5
7	3.0	14	6.0
8	5.0	09	5.0
9	3.8	08	4.5
10	3.2	18	6.5
11	4.2	15	3.5
12	5.0	16	5.0
13	4.5	09	5.0
14	3.5	09	10.0
15	4.0	29	5.0
Total		201	80.5
Average	4.0	13.4	5.4

Average Yield/acre = 25,920.0 Kgs. or 25.920 Tonns/cut.

Picture- 3. Just after planting check and plant loose planted and be pressed with feets to tighten and blockage of air. Irrigation is must just after planting.

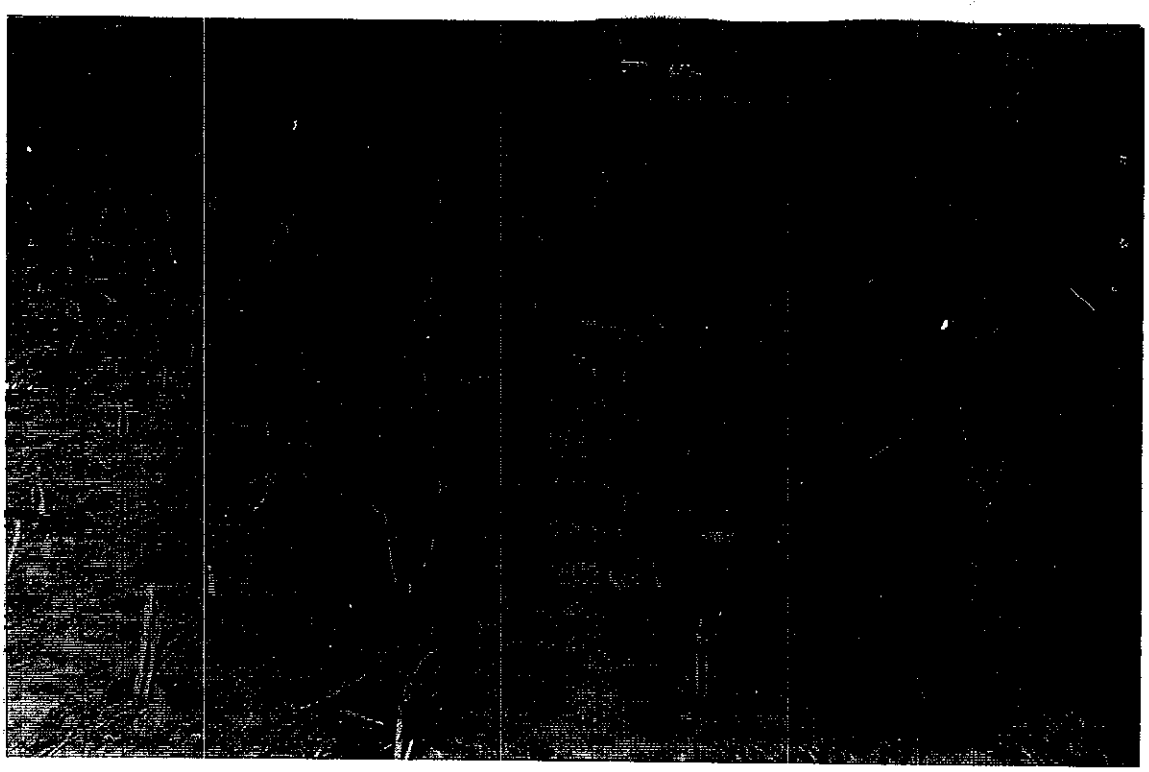


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Table- 4. MOTT (GREEN MATTER) PRODUCTION/COMPOSITION

Crude Protein (%)	= 10.71
Didestibility (DM %)	= 63.0
Average Number of Plants/Acre	= 4800
Distance (Ft.)	
Plant to Plant	= 3.0
Row to Row	= 3.0
Proper Cutting Height (Ft.)	
Average	= 5.0
RANGE	= 4.5 - 5.5
Number of Cuttings/Year	= 4 - 6
Cutting Interval (Days)	= 40 - 60
Production/Plant (Kgs.)	
Range	= 10 - 35
Average	= 22.5

YIELD PERFORMANCE (Tonnes)

Cutting Height	Per Cut Av.	Range	Per Year Av.	Range
4.5 _ 5.5	108	48.0 _ 168.0	696	192 _ 1008

Table- 5. FEED INTAKE OF ANIMALS FED MOTT AND ROUTINE FODDER

Duration of Experiment (Days)	= 30
Species of Animals	= Buffaloes

FEEDING REGIMEN

GROUP	PARTICULAR
A	Mott Grass
B	Mott + Routine Fodder (Sorghum)
C	Routine Fodder

INTAKE

Group	Average/animal	Range
A	46.13	43.26 - 48.20
B	39.40	33.90 - 44.40
C	19.83	14.66 - 26.23

Fig.2. Green Fodder Availability (F.M.)

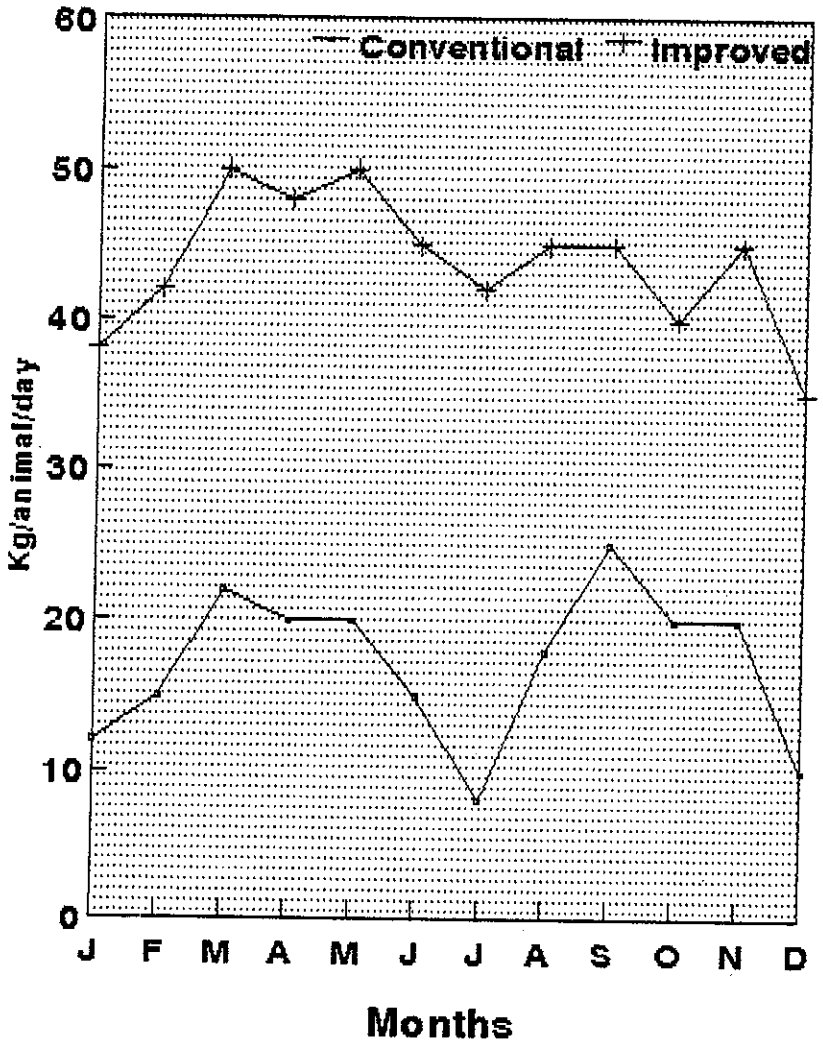
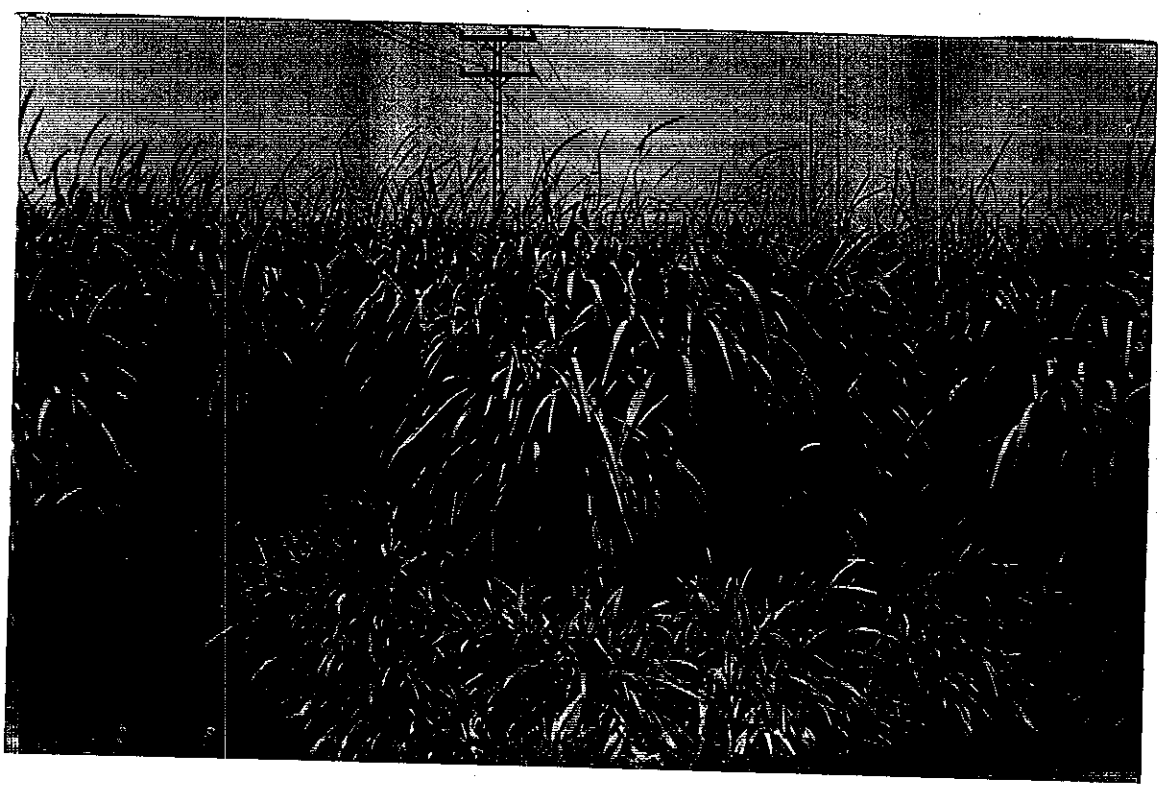


Table- 6. ECONOMICS OF SEVEN DAIRY ANIMALS ON ONE ACRE OF MOTT FODDER

Sources of Expenditure			
A. Variable Costs			
1.Feed Costs			
i) Roughage	@ 500 * 7	=	3,500
ii) Concentrates	@ 3000 * 7	=	21,000
iii) Mineral Mixes	@ 100 * 7	=	700
2.Animal Costs			
i) Breeding etc.	@ 200 * 7	=	1,400
ii) Medicine	@ 500 * 7	=	3,500
iii) Bedding etc.	@ 200 * 7	=	1,400
iv) Others	@ 300 * 7	=	2,100
3.Labour Costs			
	@ 2000*12*1	=	24,000
Total (A)		=	57,600
B. Fixed Costs			
1. Building (Depreciation, repair, interest, etc.)		=	4,200
2. Machinery		=	4,200
3. Animals		=	7,000
Total (B)		=	15,400
Grand Total (A+B)		=	73,000
INCOME			
Milk @ 10 lit./animal (21,000 * 5)		=	1,05,000
Benefits(Costs Income)		=	32,000

Picture- 4. Crop ready for cutting and feeding. This picture was taken during winter growth, shows thin leaves and stems affected by cold but still a good stand.



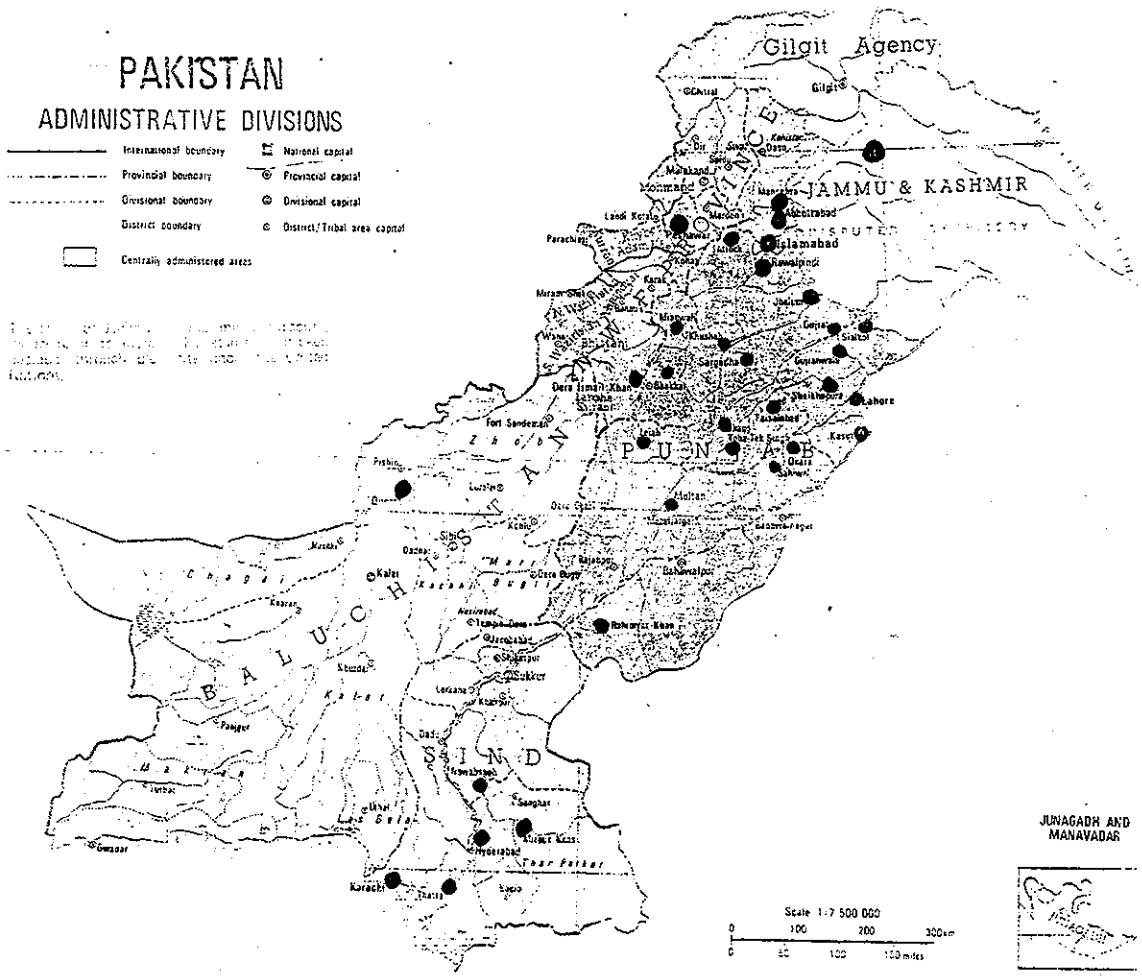


Fig. 3. Moth Distribution.

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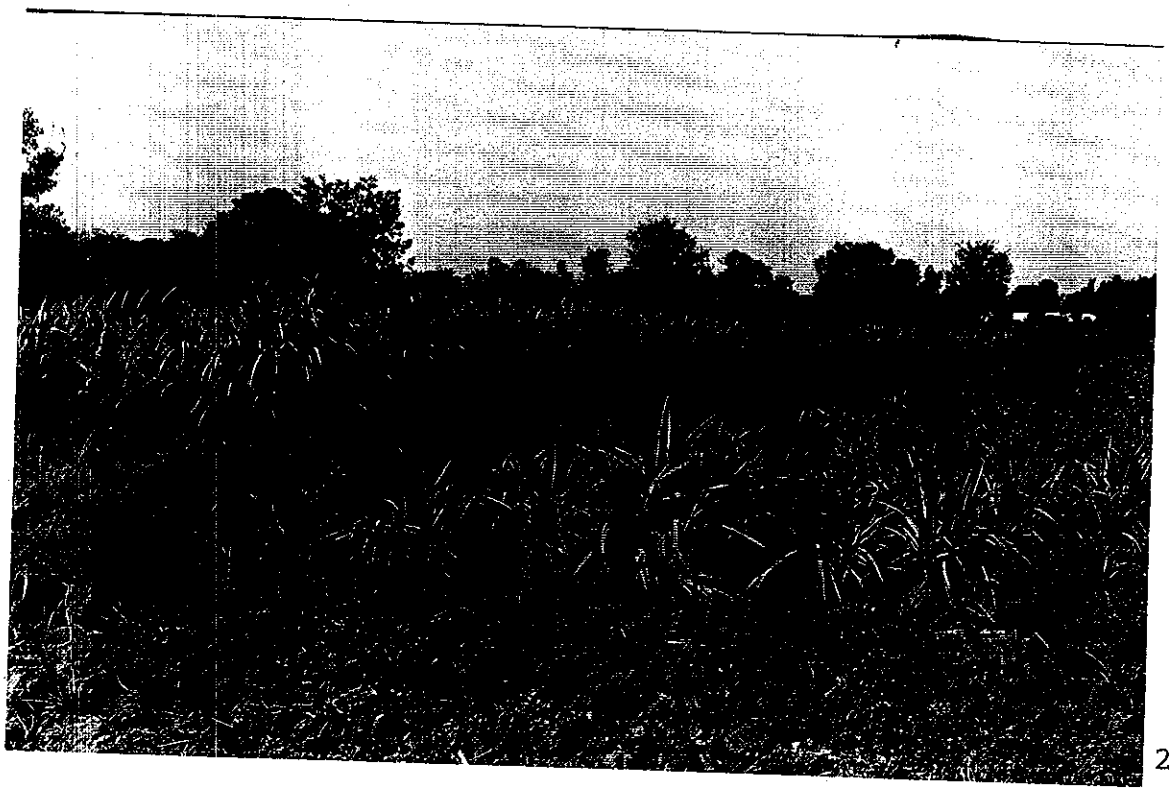
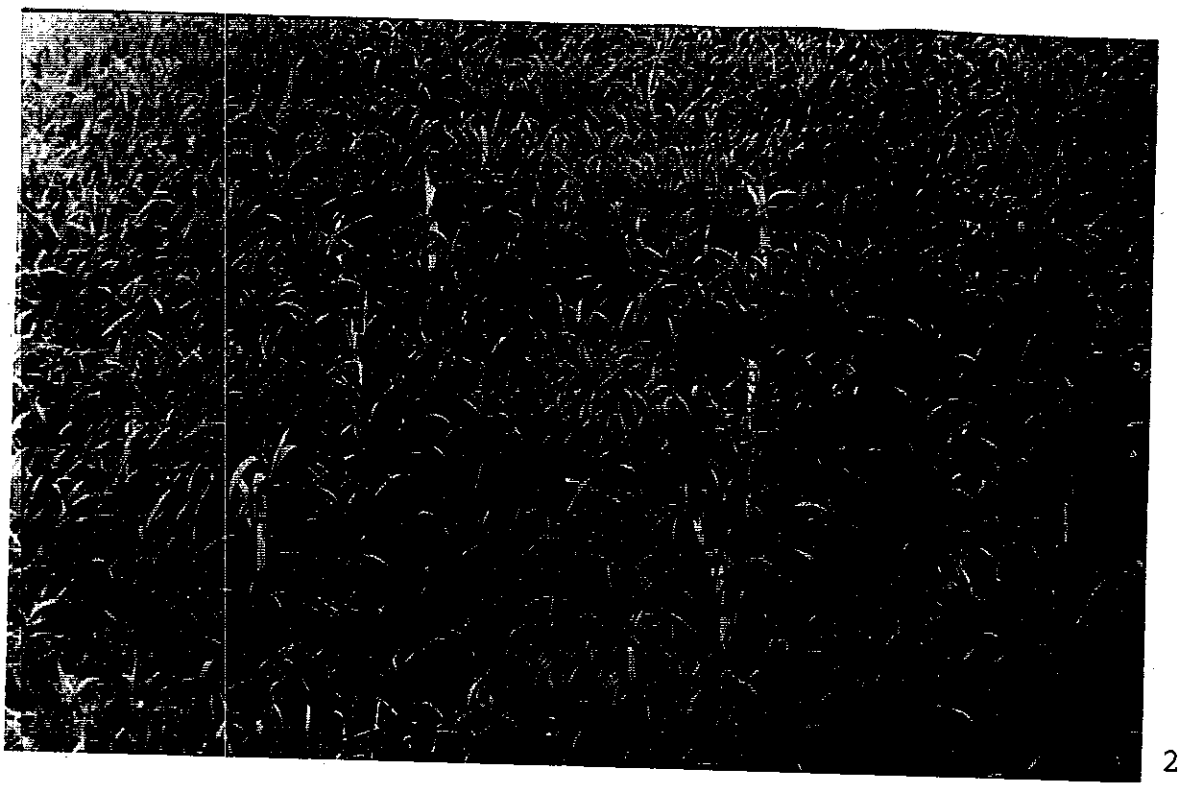
Picture- 5. A lush green material during mild season ready for cutting. At this stage material can be fresh fed and better to convert into silage if surplus and leave area for resprouting.

Picture- 6. A plot showing a length wise view. At this stage (3*3.5 ft.) can be grazed for proper use by the animals.



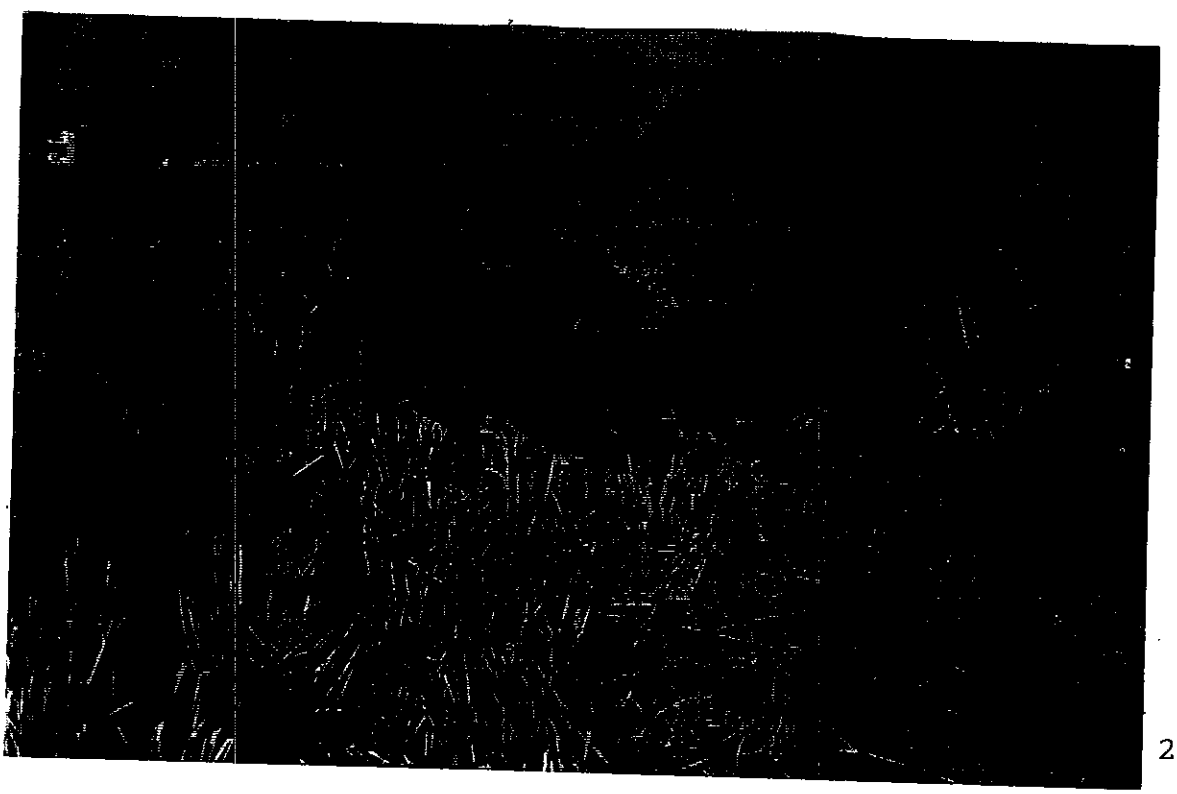
Picture- 7. If we plant this Mott in the months of March and August and planted in regular rows, a Rabi crop can be easily intercropped without harmful effects if properly managed.

Picture- 8. Picture showing Mott and Oats intercrop.



Picture- 9. Double cropping can be availed provided fertilizer is applied during Kharif season.

Picture- 10. Mott can be in better way grazed for labour saving in dairy farming but proper height of plants may be kept in mind (3*3.5 ft.)



ENRICHMENT AND PRESERVATION OF STRAWS/SUPLUS FODDERS

The major limiting factor in the productivity of livestock in our country is the scarce availability of quality feed and fodder. The green fodder available is not sufficient to meet all the nutrient requirements of the animals. This deficiency is more pronounced in the dry areas where the green fodder is limited. During certain part of the year shortage of fodder is acute. Solution to this shortage is only properly manage the existing feed and fodder resources and can be utilized with better results i.e., enrichment and preservation of straws/stovers/surplus fodders.

Wheat straw is the biggest energy source for ruminants but deficient in protein and has poor digestibility due to high cell wall constituents. Urea treatment is a low cost and simple technology and it improve intake and digestibility of straws.

The performance of animals, however, decline markedly when straws are the only major source of feed because of their low nutrient contents, poor digestibility and low voluntary intake.

Bulk of animal feed consisted of poor quality high fibre green fodder or wheat/rice straw. The straw treatment was demonstrated at several sites. To compare the feed value of treated and untreated straw a treat was conducted.

The cows exhibited significantly higher intake of the treated-wheat straw and lower green fodder consumption . While no significant differences were noted in either milk yield or composition, the study showed that treated straw may partially substitute for green fodder when pasture is scarce (Fig-4).

On-farm experimantation in the target areas indicated that treated starw increases the nutrient supply, saving of Rs. 0.10/litre of milk produced, low green fodder consumption, increased treated straw intake and to some extent substitutes the green fodder particularly during scarcity periods.

On-station experimentation indicated a greater scope for inclusion in normal feeding of dairy animals. Statistical analysis indicated that there were non significant differences in milk composition and production of buffaloes fed ureatreated and untreated wheat straw. The feed intake (Wheat straw, green fodder and concentrate)

in both the groups also did not differ significantly (Table- 7). The feed shortage problem can be solved by augmenting the supplies of animal feed through improved technologies for enrichment of low quality roughages.

Treated straw demonstration work was under taken by using farmer source of straw totaly and fertilizer urea partially, and neighbouring farmers were invited to observe and learn the technological package.

About 200 farmers were selected and work was done at their farmstead. This whole job was conducted with the kind help of Milkpak Ltd., Livestock Production Officers.

Other staff members of the Livestock Production Project were also given training for optimal use of technology.

The maximum production potential of our livestock is seldom attained simply because adequate feed specially the green fodder is not available throughout the year.

Picture- 11. A measured length and width of a device mostly used in farming community for taking straws/roughages. Thumb rules are used for training personnels for easy understanding and time saving in the treatment process.

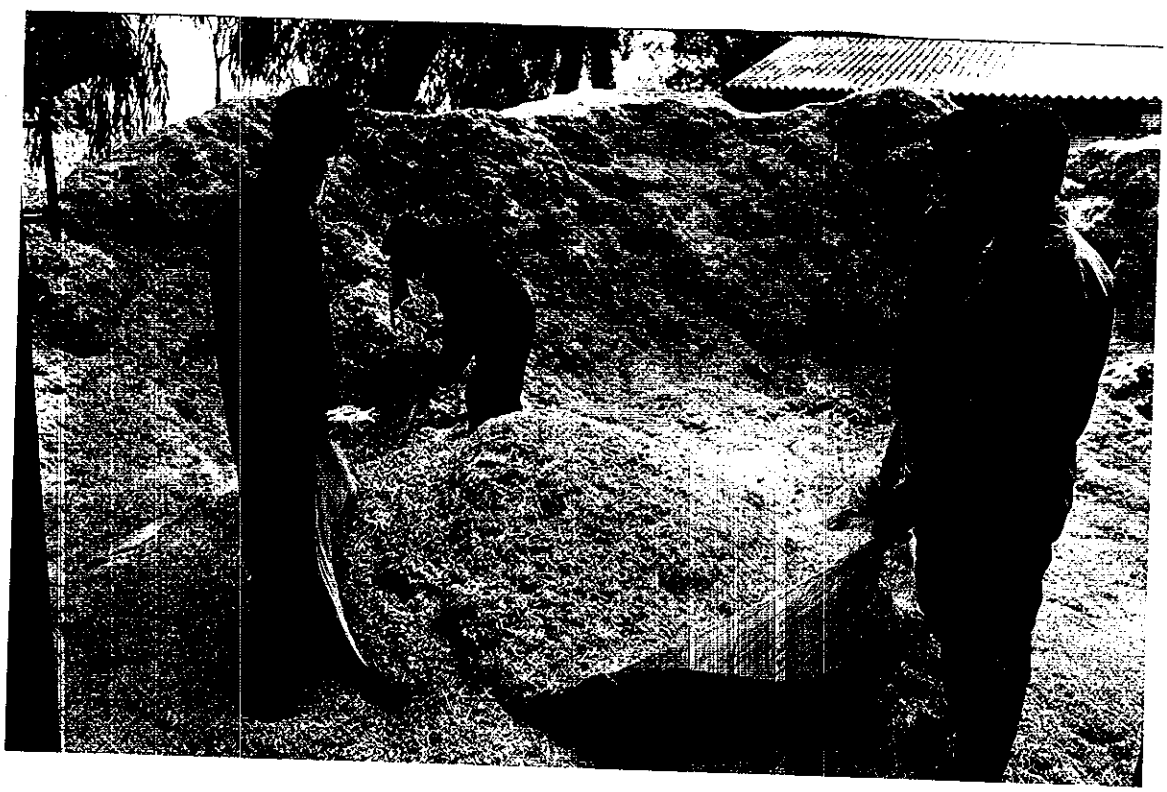


FIG.4.AV.DAILY FEED INTAKE AND MILK YIELD

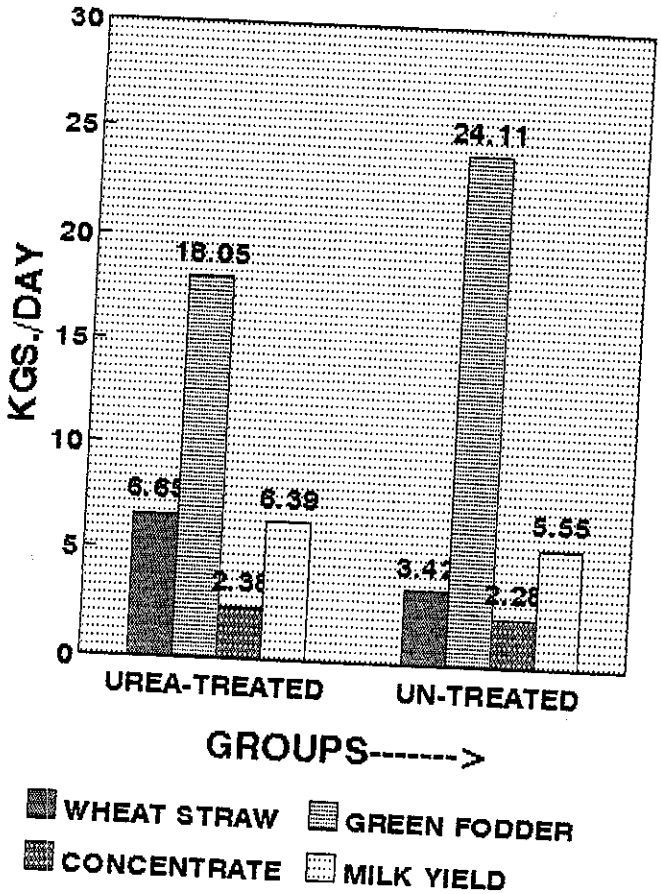
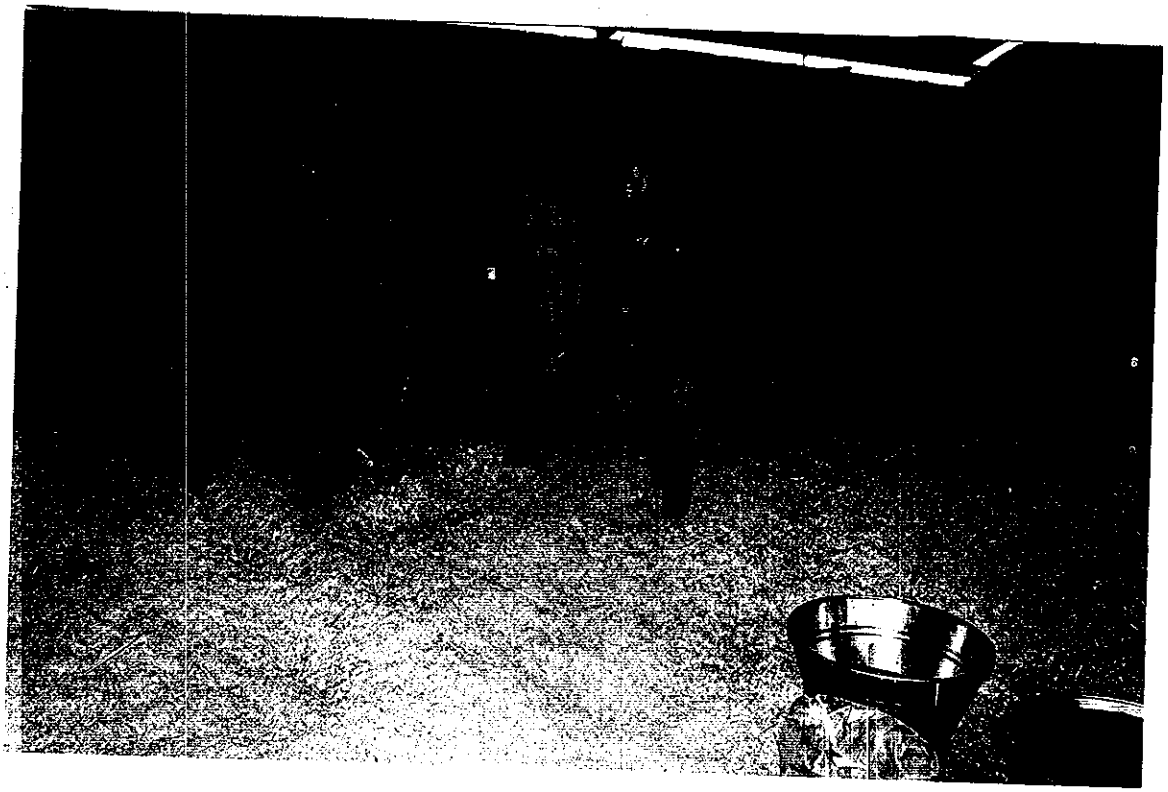


Table 7. AVERAGE DAILY FEED INTAKE, AND MILK YIELD OF THE NILI RAVI BUFFALOES FED ON DIFFERENT REGIMENS

PARTICULARS	UN-TREATED STRAW	UREA-TREATED
Animals	8	8
Days on Expt.	84	84
Av.Daily feed Intake (Kgs.)		
a)Wheat Straw	4.52 ± 0.24	4.55 ± 0.38 NS
b)Green Fodder	32.51 ± 0.97	33.20 ± 1.12 NS
c)Concentrate	2.80 ± 0.11	2.81 ± 0.12 NS
Av. Daily Milk Yield (Kgs.)	8.60 ± 0.37	8.86 ± 0.44 NS
Milk Composition		
Fat	5.51 ± 0.11	5.72 ± 0.10 NS
Protein	4.68 ± 0.08	4.77 ± 0.09 NS
Solids not fat	9.07 ± 0.12	9.04 ± 0.10 NS
Total Solids	14.66 ± 0.15	14.80 ± 0.19 NS
Cost of 1 Kg. Milk (Rs.)	3.04	3.08

Picture- 12. Urea solution is being prepared by the trainees for straw treatment.

Picture- 13. Four (4) per cent prepared urea solution is being sprinkled over measured quantity of straw. After sprinkling over total quantity is stacked in conventional ways as farmers are practising.



Silage preparation at farm level has been successfully accomplished using several materials (sorghum,maize,sugar cane tops, citrus pulp).The seasonal surplus fodder can be effectively converted into silage for use during scarcity period.

In experiments to test the effect of feeding silage on the production performance of buffaloes under field conditions. The feed intake values on dry matter basis for silage feeding and routine fodder were 8.47 and 8.86 kg., respectively. The analysis of variance revealed a non-significant difference in milk production, milk protein, SNF, total solids and ash. Highly significant differences ($P<0.01$) in feed intake were observed (Fig-5).

The results of earlier on-farm validation phase suggested that silage/hay making and feeding can be practiced as a source of green roughage to greater extent during the periods of green fodder scarcity especially for dairy animals.

Results of various on-station feed back experiments also indicated that there were statistically non-significant differences in milk composition of buffaloes fed sorghum silage and green fodder (sorghum). However, animals in group A (fed sorghum silage) produced

significantly more milk on as such basis as well as on FCM basis as compared to those fed green fodder (Table- 8).

There was no significant difference in consumption of sorghum silage and green fodder on dry matter basis but concentrate consumption was significantly higher in group A as compared to that of group B. The results of the present study suggested that feeding of silage to lactating buffaloes may be considered to give results comparable to those obtained from routine fodder. Silage feeding as a substitute for green forage can be practised to a great extent in dairy animals during the periods of fodder scarcity.

All fodder for silage/hay making for demonstration was provided by the farmer. Labour was provided by the farmer for digging pit and proper sizes of the pits were demonstrated to the farmers for proper preservation of fodder. Other materials were partially provided to the farmers using project funds.

In the project areas we were able to demonstrate silage/hay making technique in winter and summer seasons to about 96 farmers. These farmers will serve as a source of guidance for other farmers.

At various sites with the help of Livestock Production Officers field days were arranged in the villages and technology was demonstrated to the farmers and also urdu literature was given to them for study purposes.

Picture- 14. Farmers are hearing demonstrations for the preservation of succulent fodders into silage dumped in silo-pits by the experts.

FIG 5. AV.DAILY FEED INTAKE & MILK YIELD

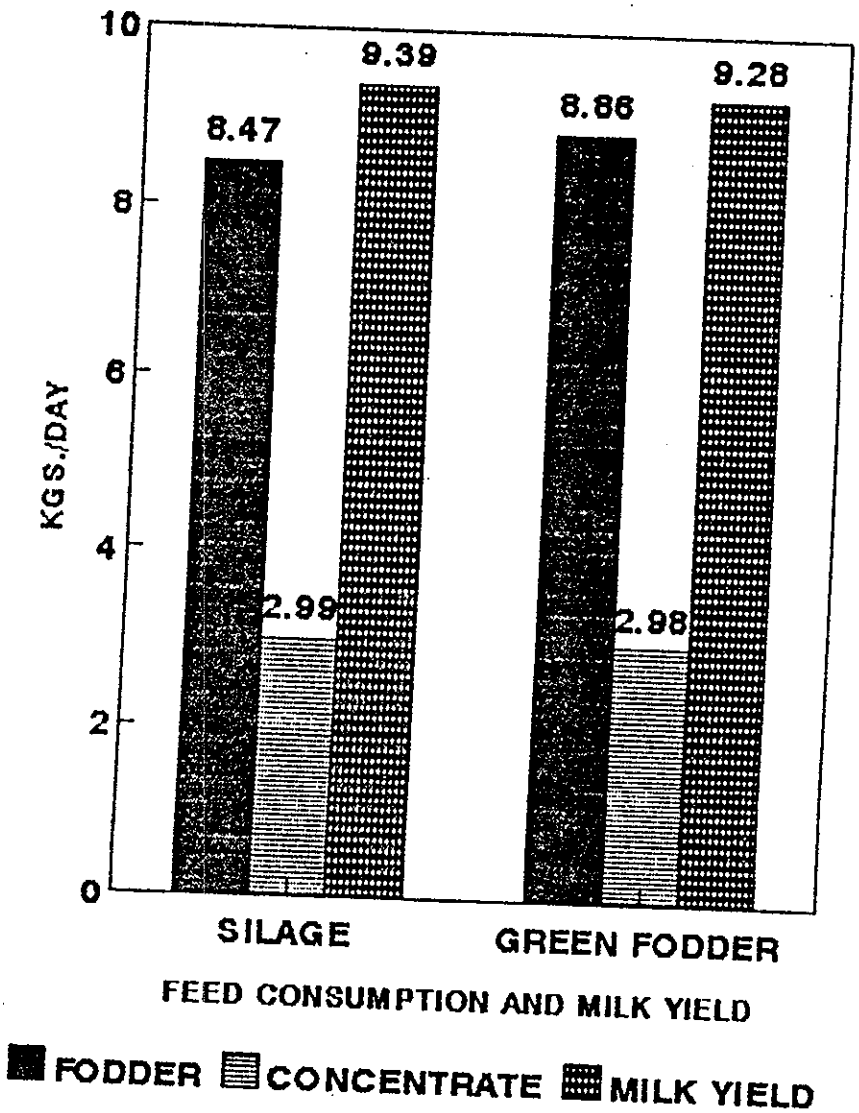


Table 8. AVERAGE MILK PRODUCTION AND FEED CONSUMPTION OF ANIMALS FED ON DIFFERENT REGIMENS.

PARTICULARS	GREEN FODDER REGIMEN A	SORGHUM SILAGE REGIMEN B
No. of Animals	6	6
Days on Expt.	84	84
Daily Milk Yield (Kgs)		
As such basis	7.28 ± 0.05	7.47 ± 0.04 *
FCM basis	9.08 ± 0.06	9.39 ± 0.06 *
FEED CONSUMPTION		
Silage (Kgs)	-	8.49 ± 0.08 NS
Green Fodder (Kgs)	8.26 ± 0.07	-
Concentrate (Kgs)	2.97 ± 0.02	3.01 ± 0.02 *
Milk Composition (%)		
Fat	5.74 ± 0.10	5.80 ± 0.10 NS
Protein	4.78 ± 0.07	4.67 ± 0.08 NS
Total Solids	15.14 ± 0.12	15.15 ± 0.12 NS
Solids not fat	9.40 ± 0.05	9.35 ± 0.06 NS

* = Significant NS = Non-significant

Agro-industrial Wastes and Animal Production.

Agriculture industry is producing huge quantities of by products and wastes. These millions of tonnes of wastes and by products like sugar beet pulp, fruit peelings, fruit processing plants wastes, (Citrus pulp), etc. can be used in a better way by simple techniques into a good quality feed for animals.

Citrus is converted into silage by mixing it with wheat straw (80:20) and fed to animals. The scarce feed availability can be improved. Almost 50% of the green fodder could be replaced by citrus pulp (Table- 9).

Picture- 15. Citrus pulp a waste of citrus juice industry can be fed fresh to animals and other wise can be preserved by using silage making technology for future scarcity use.

Table_ 9. Effect of feeling different levels of citrus pulp silage on production of lactating Buffaloes.

Description	Citrus pulp Group		Control Group
Regimes	Replacement 50%	100%	
Citrus pulp	50	100	
Berseem and straw	50		100
Concentrate (Kgs)	2	2	2
Composition			
DM	14.68	14.5	14.87
Crude protein	07.75	08.8	06.70
Crude Fiber	12.76	12.7	12.82
Crude Fat	02.76	03.4	02.12
Ash	05.63	05.1	06.16
Feed consumption			
Feed Intake (DM)	11.69	11.67	11.55
Milk (kgs)	05.75	05.90	05.23
Fat (%)	07.13	07.08	07.23

Picture- 16. Lactating cows can also be fed on citrus pulp.

MULTIPURPOSE TREES/GRASSES

Small ruminants are facing feed shortage throughout the year especially during certain period of the year. These animals are playing major role in the supply of quality food to humen beings. In spite of all that very little attention has been paid by the farming community and to research and development. Feed shortage is critical problem which lower the productivity of animals and thus affecting the income of farmers. To add up fodder availability fodder trees/grasses can play major role.

Earlier on-station work indicated significant differences in weight gain and net income when compared with conventional type of feedings.

Fodder trees and grasses were introduced at farmers fields to increase the fodder availability. The fodder trees were planted and propagated at Post-graduate Animal Research Station (PARS), Proka for on-station research. Under field conditions several sites were planted on field boundries and on water courses. Several grasses and fodder trees have been introduced and studies on feeding combinations and production are under way (Table- 10).

Table- 10. Promising Agro-forestry Species Under Trial.

GRASSES

- B.N.Hybrid
- Guinea Grass
- Silk Grass
- Sucro
- Dallis Grass
- Buffal Grass (Cenchrus ciliaris)
- Green Panic
- Tall Panic
- Setaria Anceps
- Lemon Grass
- Khabbal Grass (Cynodon dactylon)

FODDER TREES

- Iple Iple (Leucaena leucocephala)
- Acacia nilotica
- Acacia arabica
- Mulberry (Morus alba)
- Beri (Ziziphus jujuba)

Other non-conventional trees/shrubs were also tested for chemical composition to be used as roughage source for the animals (Table- 11).

Table- 11. CHEMICAL COMPOSITION OF NON-CONVENTIONAL FEEDS (FALSA AND KAURA)

Particulars	Falsa	Kaura
	----------Percent----------	
Crude Protein	10.94	08.20
Crude Fat	02.58	01.66
Crude Fibre	42.89	24.41
Nitrogen Free Extract	36.45	54.15
Ash	07.14	11.58

So to overcome these shortage periods (May, June, November and December) non-conventional feed resources can be utilized with better results i.e. enrichment of straws and supplementation of fodder tree leaves.

During the period of fodder scarcity, such tree leaves are greatly sought as a source of fodder. These resources are of considerable value as livestock feed and can be greatly developed by increasing number of such trees and proper management practices to obtain optimum yield. Among varieties of fodder tree leaves, leucaena leucocephala is very palatable to livestock.

Wheat straw is the biggest energy source for ruminants but is deficient in protein and has poor digestibility due to high cell wall constituents. Urea treatment is a low cost and simple technology and it improve intake and digestibility of straws.

Cereal straw have traditionally served as major ingredient for livestock feeding in the South Asian countries including Pakistan. The performance of animals, however, decline markedly when straws are the only major source of feed because of their low nutrient contents, poor

digestibility and low voluntary intake.

The young calves after weaning are improperly fed leading to stunted growth and late sexual maturity. The life time production is also adversely affected in case of females. Therefore, an experiment was conducted to study the raising of buffalo heifers on fodder tree leaves (Leucaena leucocephala) and urea-treated straw with green forages.

The average weight gain during a period of 90 days was 24.49 Kg. per animal in the control group A consisting of 100 percent Berseem, whereas, in experimental groups fed forage mixture B, C and D containing 75 % Berseem plus 25 % urea-treated straw, 50 % Berseem plus 25 % urea-treated straw and 25 % Leucaena leucocephala, and 37.5 % Berseem plus 25 % urea-treated straw and 37.5 % Leucaena leucocephala was 26.22, 70.2 and 23.89 Kg. per animal, respectively . Highest gain (70.2 Kg) was obtained in heifers fed mixture containing 50 percent Berseem plus 25 % urea-treated straw and 25 % Leucaena leucocephala (Table-12).

The statistical analysis of data revealed that heifers in group C had significantly higher weight gain. The Duncans multiple range test revealed non significant difference among A, B and D group. The results indicated that weight gain was depressed when Iple Iple level was increased and Berseem was reduced.

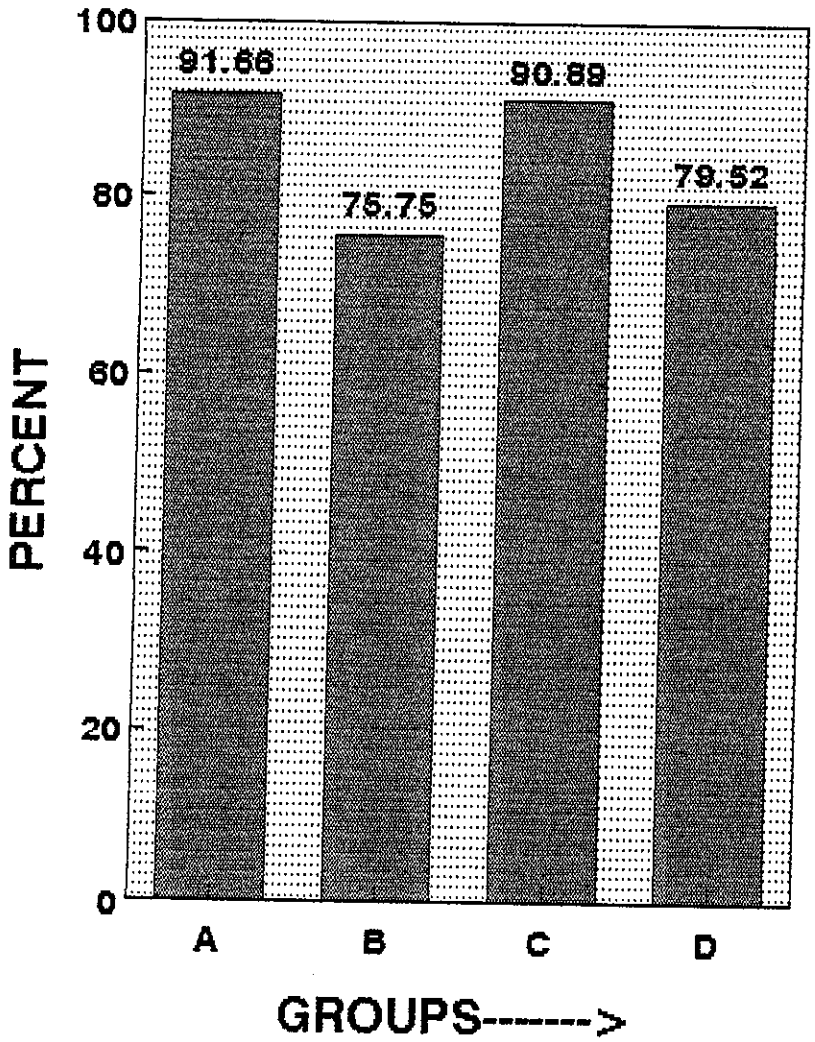
The average apparent dry matter digestibility of rations containing berseem only, berseem plus urea treated straw, berseem plus urea treated straw plus Leucaena leucocephala and berseem plus urea treated straw plus Leucaena leucocephala (Iple Iple) was 91.66 %, 75.75 %, 90.89 % and 79.52 %, respectively . Digestibility was highest in ration consisting berseem only which was 91.66 %. Second in order was berseem plus urea treated straw and Leucaena leucocephala

(Group-C) which was 90.89 % forage mixture containg berseem plus urea treated straw showed lowered dry matter digestibility (Figure-6).

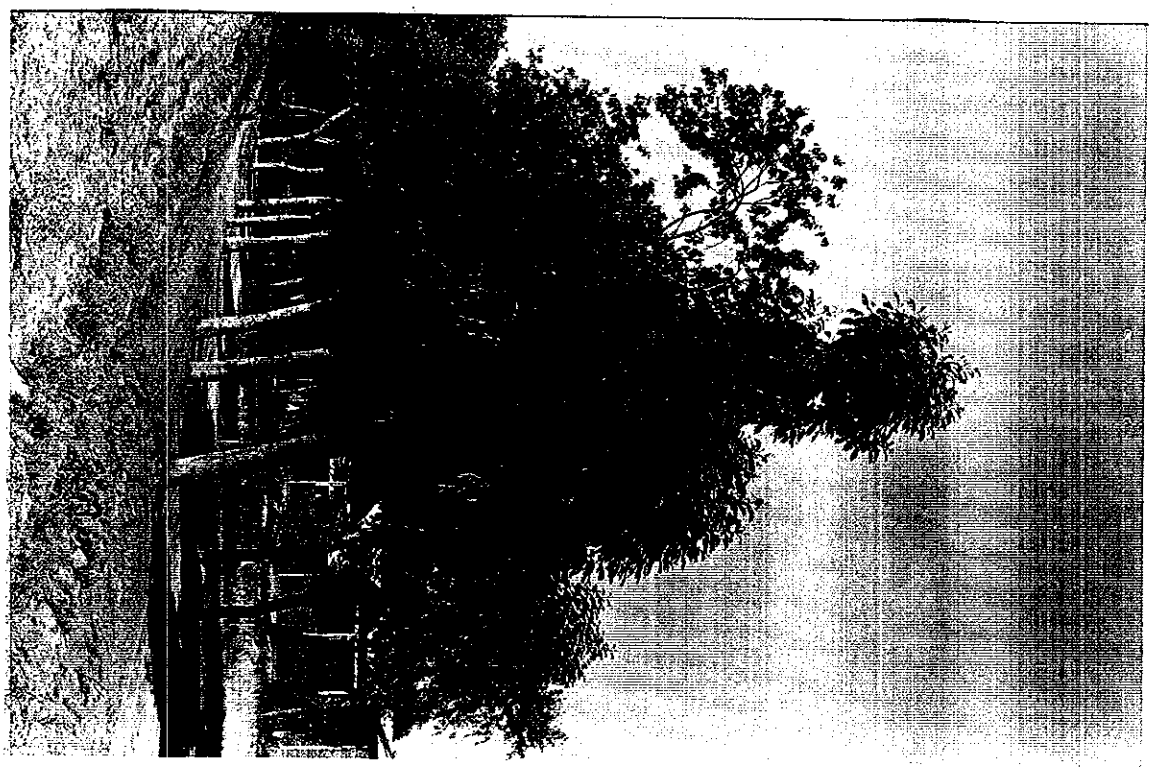
TABLE NO- 12. AVERAGE FEED CONSUMPTION AND WEIGHT GAIN DATA

Description	A	B	C	D
No. of animals	3	3	3	3
Days on experiment	90	90	90	90
Av.initial weight	71.18	75.51	67.09	61.65
Av.final weight	100.17	101.73	137.29	85.54
Av.total weight gain	24.49	26.22	70.20	23.89
Av. daily gain	0.327	0.291	0.78	0.265
Av.dry matter consumption	17.36	14.88	10.56	8.88

FIG.6.AV. DRY MATTER DIGESTIBILITY

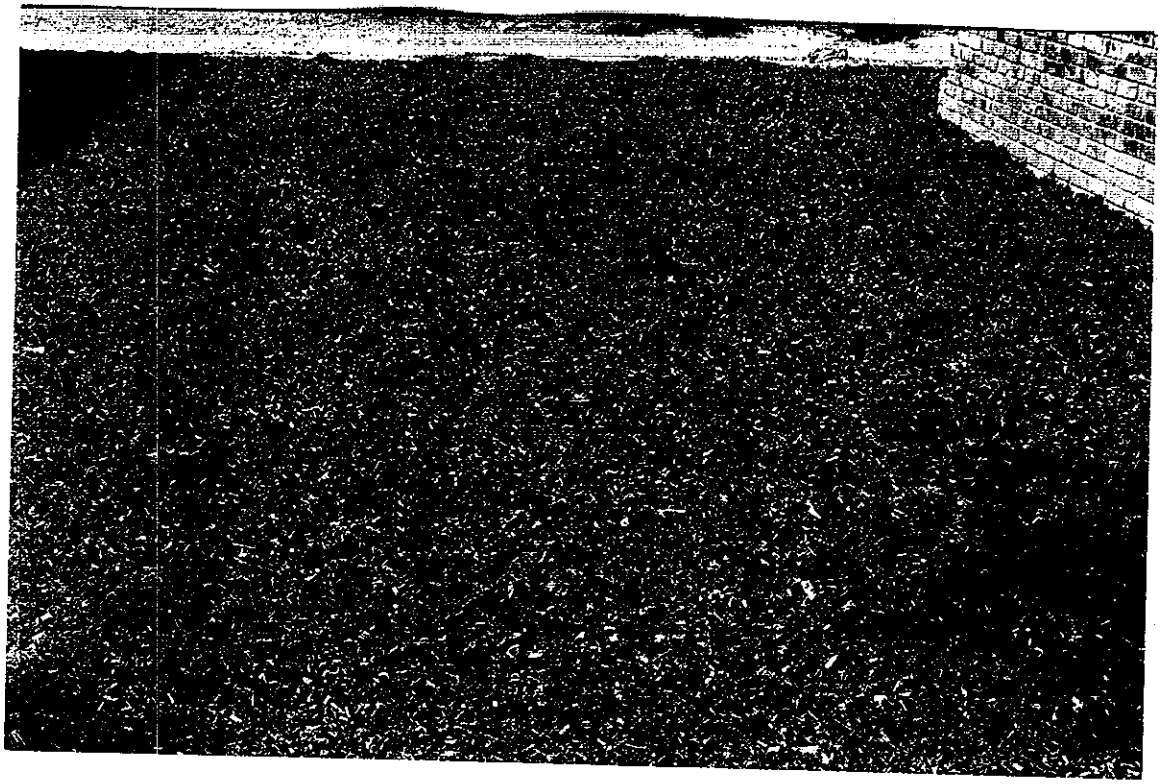


Picture- 17. A miraculous fodder tree Iple Iple (Leucaenaleucocephala). Multipurpose providing high quality feed for ruminants and fuel for cooking.



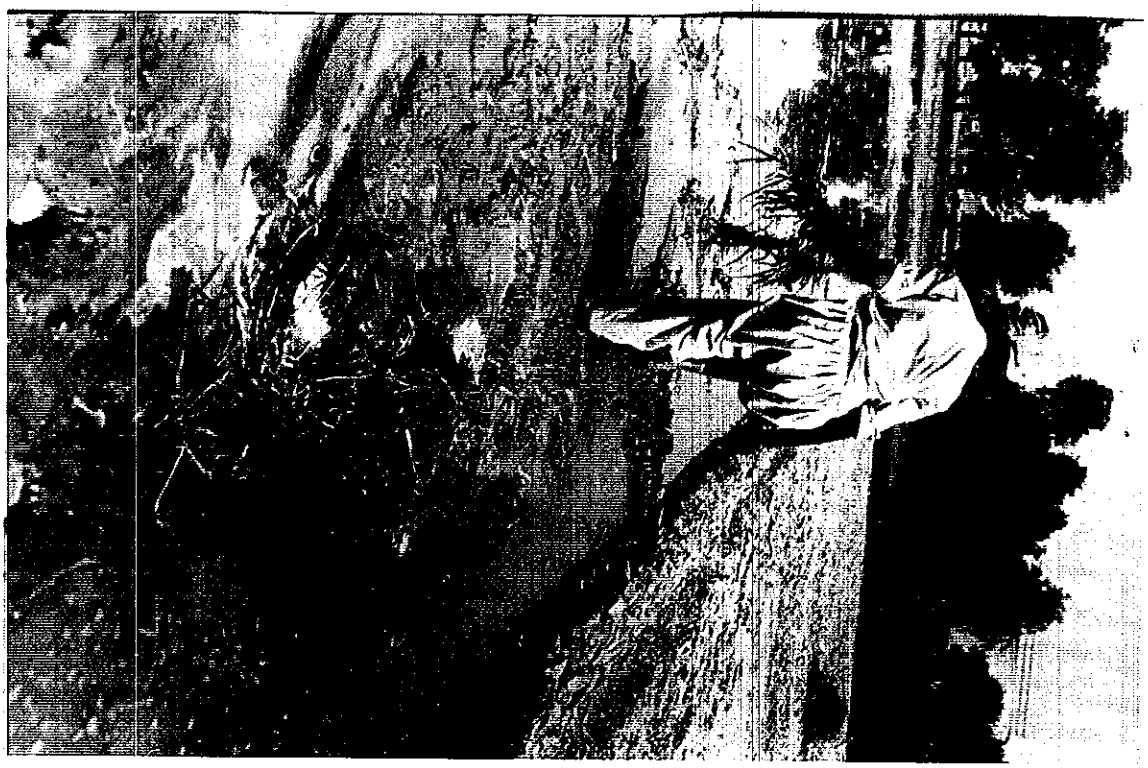
Picture- 18. Another field of Agro-forestry unit. A combination of fodder trees and grasses.

Picture- 19. Twigs and leaves of Iple Iple can be converted into hay by properly cutting, chopping and drying.



Picture- 20. Farmers are trying to propagate grasses under the advice of FSR team.

Picture- 21. Another way of planting grasses in irrigated soils.



Picture- 22. Grazing pattern and management in dairy cows.

FEED AND MINERAL SUPPLEMENTATION

Among the nutritional deficiencies, mineral deficiencies are usually responsible for affecting the normal rhythmicity of reproductive organs. Dietary nutrient deficiency is a common cause of reduced fertility which is linked with delayed onset of puberty, sexual maturity, anoestrous, poor growth, poor conception rate, early embryonic mortality and irregular oestrous cycle. There is clear cut evidence that reduced calcium and phosphorus levels in blood causes late maturity, silent heat and anoestrous.

Buffalo is the major dairy animal of Pakistan and contribute upto 76 per cent of the total milk production in the country. The buffaloes maintained by village farmers are usually under fed and malnourished. Their reproduction and production is sub-optimal causing economic losses due to reproductive failure are either due to permanent sterility or lowered fertility (late sexual maturity, anoestrous and longer calving interval).

Most of the research work indicated a complex interaction between energy or mineral deficiency in diet and body development, reproductive efficiency as well as lactation.

The calving interval of rural buffaloes was estimated to be 15.8 months with a range of 30 to 90 months. Late maturity has been attributed mainly to slower rate of growth which was related to general dietary insufficiency.

It is therefore, necessary to supplement sufficient amount of these minerals in the feed to meet the requirements and to build up body reserves during various physiological phenomenon of animals life to ensure the optimum production.

On-farm experimentation has clearly indicated that all the animals must be supplemented with simple sources of minerals (Dicalcium Phosphate) at least especially the young female stock which is future replacement (Table-13).

Results of experiment indicated net benefits of Rs. 1776 per animal by simply feeding DCP costing Rs. 24 for 120 days duration.

Feeding trial was conducted involving 8 lactating buffaloes of about same age and lactation stage to study the effect of conventional cotton seed cake and cattle feed feeding on milk production. The two

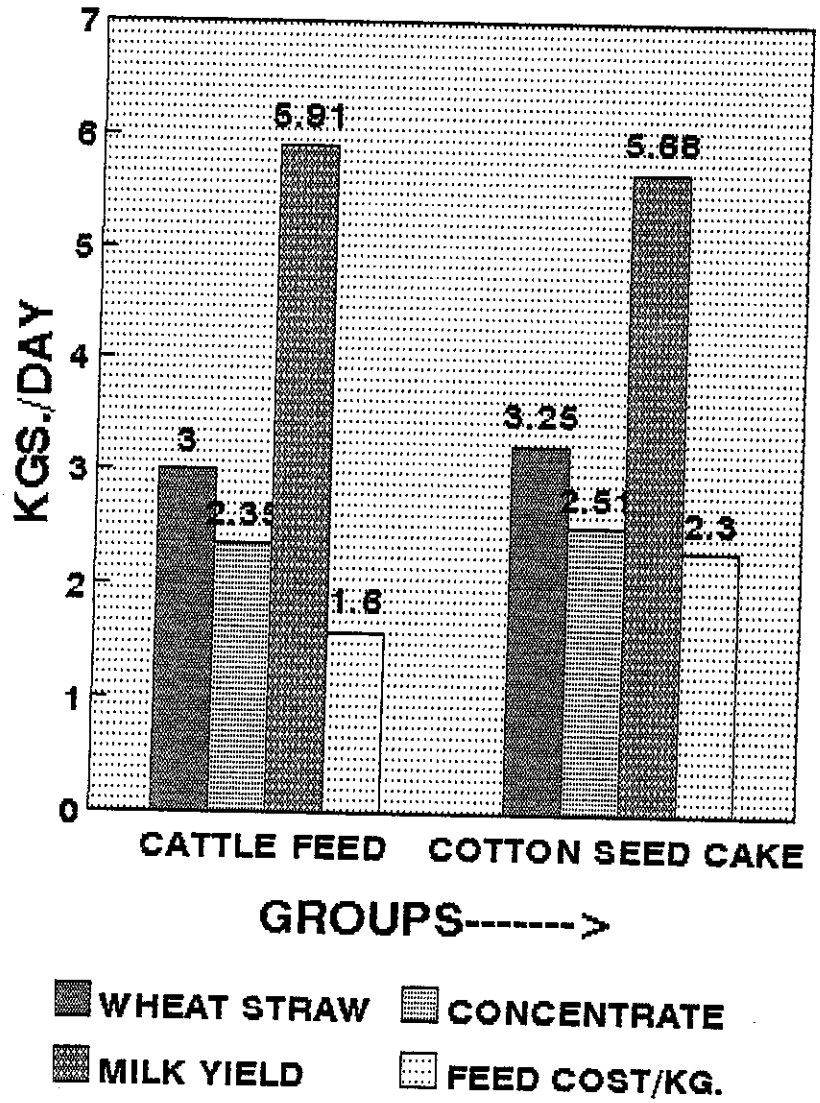
concentrates were randomly alloted to the experimental animals in two groups of four animals each according to double reversal or switch back design in a way that each concentrate was tested on each animal. Milk production of cattle feed group and cotton seed cake group was 5.91 and 5.68 litres, respectively and feed cost per Kg was Rs. 1.60 and Rs. 2.30 (Fig-7). Total variable costs incurred for cattle feed group and cotton seed cake was Rs. 8.95 and 11.09, respectively . Net benefits were Rs. 8.78 and 5.95 from cattle feed group and cotton seed group, respectively.

Table 13. EFFECT OF FEED AND MINERAL SUPPLEMENTATION ON SEXUAL MATURITY AND CONCEPTION RATE IN BUFFALO HEIFERS.

PARTICULARS	GROUP-- A	B	C	D
Treatment	RF+ DCP	RF+ Conc.	RF+ DCP+ Conc.	RF
Animals (No.)	10	10	10	10
Animals Pregnant	7	3	7	1
Percent Animals Pregnant	70	30	70	10
Appreciation Value (Rs.)	24600	17400	24600	12000
Feed Consump.(Gms.)				
Concentrate	-	1000	1000	-
Dicalcium Phos.	50	-	50	-
Total Variable cost.(Rs.)	240.0	2400.0	2640.0	-
Intervent. Benefits(Rs.)	12600	5400	12600	-
Net Benefits (Rs.)	12360	3000	9960	-
Cost Benefit Ratio	1:51.5	1:1.25	1:3.77	-

Picture- 23 A least cost ration is provided to the farmers for feeding to lactating animals

FIG.7.AV.DAILY FEED INTAKE AND MILK YIELD



DEWORMING/VACCINATION OF ANIMALS

Although sheep are less susceptible to health problems than other farm animals, internal parasites are a constant threat to economical production. sheep have a cleft upper lip allowing them to graze very close to the ground. This characteristic provides for close contact with eggs and larvae of internal parasites that also can live in the soil.

Few sheep are killed by internal parasites, damage comes mostly from poor growth and unthriftiness. Tapeworms, lungworms, nodularworms and stomach worms are the most common infestations. Low lying areas may also harbour liver flukes because snails are intermediate hosts that inhabit wet localities.

Signs of parasites in animals mostly are paleness of eyelids (anaemia), poor growth, potbellies and bottle jaws or poverty jaw. Proper treatment at proper time interval and with proper anthelmintics is prescribed effective in restoring optimum health.

Previously several interventions were taken over to demonstrate and to test the effect on growth performance of sheep at several sites in the project areas.

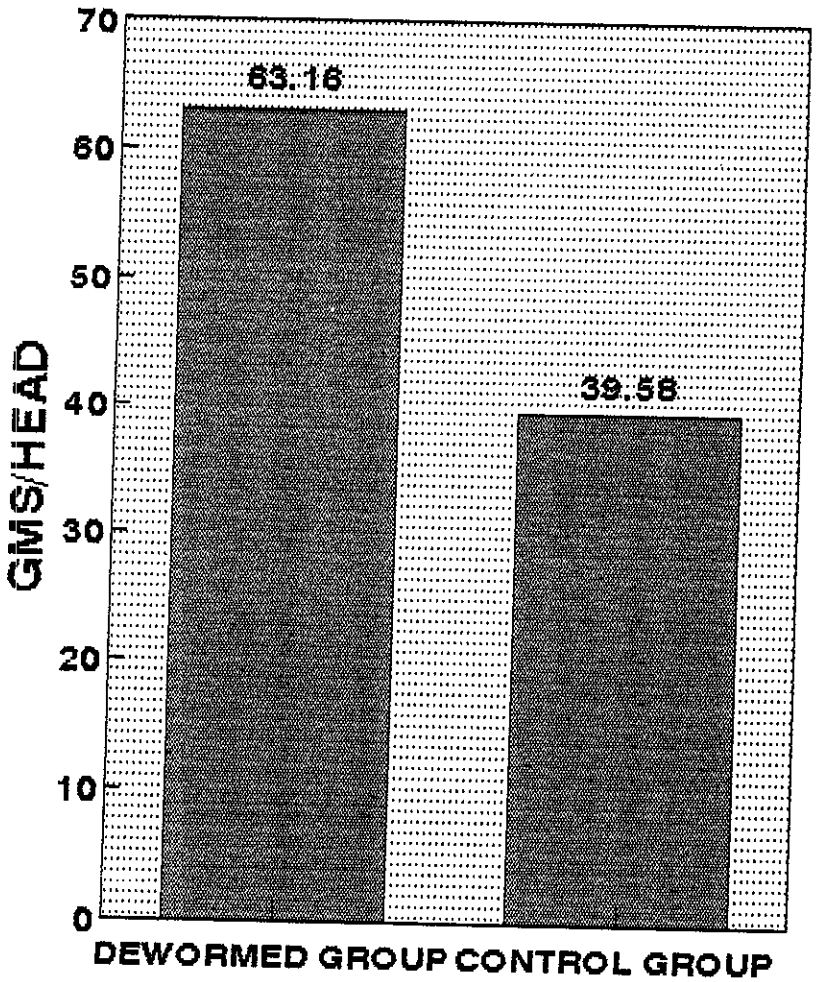
Animals were drenched using Nilworm, Oxafax, Systamex and Nilzan for the proper control of internal parasites in small ruminants and youngstock. On an average treated animals perform better in the form of weight gain as compared to untreated animals. It was also observed that treated animals graze and eat more and better quality feed. They were better in out look and less prone to disease (Fig- 8). Other species and age groups were also treated for the control of endo and ecto-parasite at several sites in the area.

Farmers were properly trained as for as proper dosage according to body weight and species is concerned as prescribed by the company. They were also instructed to redrench at about 3 to 4 months interval.

Farmers are best judge of all the activities with him, so they were fully convinced of the benefits of controlling parasites to get maximum output from their endeavours.

Vaccination programme was also undertaken with the help of Veterinary officers and our field staff.

FIG.8.ECONOMIC BENEFITS OF DEWORMING



WEIGHT GAIN/DAY

Picture- 24. Animals are being drenched using certain volume of anthelmintics according to species and body weight.

Picture- 25. Vaccination programme is adopted according to prevailing diseases in the target areas.

RESEARCH AND TRAINING

The goal of improving livestock production is particularly frustrated in places where there is lack of trained personnel to provide leadership. Developing competence in this field require training as extensive as in any field of agricultural and biological sciences. This level of training cannot obtained by giving to animal husbandry only cursory attention as a part of another field of agricultural sciences. Competence in animal production has depended almost entirely upon veterinary education. We can no longer afford this limited approach. It is particularly important in developing countries like Pakistan that animal production scientists/field workers be available and trained not only in the field of breeding/genetics, nutrition, livestock and poultry management and fodder agronomy but also in in other allied fields.

Pakistan recent interest in FSR has emphasised the urgent need to train scientists of the public and private sector in the approach and methods of FSR/E. It is now generally accepted that raising productivity and net farm income can be realized when scientists and farmers become partners in problem diagnosis and analysis and testing improved cultural practices by the small farmer will also require strengthening the linkage between research and extension.

Livestock Production Officers were given training in all aspects of animal management. They were materialised and practically all the pilot to production interventions were demonstrated regarding increased fodder production, enrichment of crop residues (Straws/Stovers), fodder preservation in the form of silage and hay, proper utilization and importance of feeding minerals and concept of balance feeding. Proper use of fodder trees/grasses was also demonstrated to produce a low cost source of high quality feed for all type of animals.

They were also given training to manage other managemental problems faced by the farmers due to improper housing and other hygienic

conditions. In this training course about 45 scientists were properly trained by our scintists. Now these LPO's are working under the Department scheme on the same pattern as FSR work was started and accomplished.

Field days were also arranged at several sites with the help of FSR team and other government and private agribussiness peoples. Farmers were given training to get it done properly all the ralated work as for as these interventions are concerned.

Poultry keeping under the village conditions on economical lines was demonstrated to working village womens in these areas.

Work has also been started to device FSR courses for Undergraduate and postgraduate students to familiarise the students with latest research and technology transfer tachniques and ways and means of conducting on-farm research.

Some of the courses has been designed and proposed for approval by the University Authority with the collaboration of Department of Agriculture Educatuion and Extension,Agriculture Economics and Agronomy.

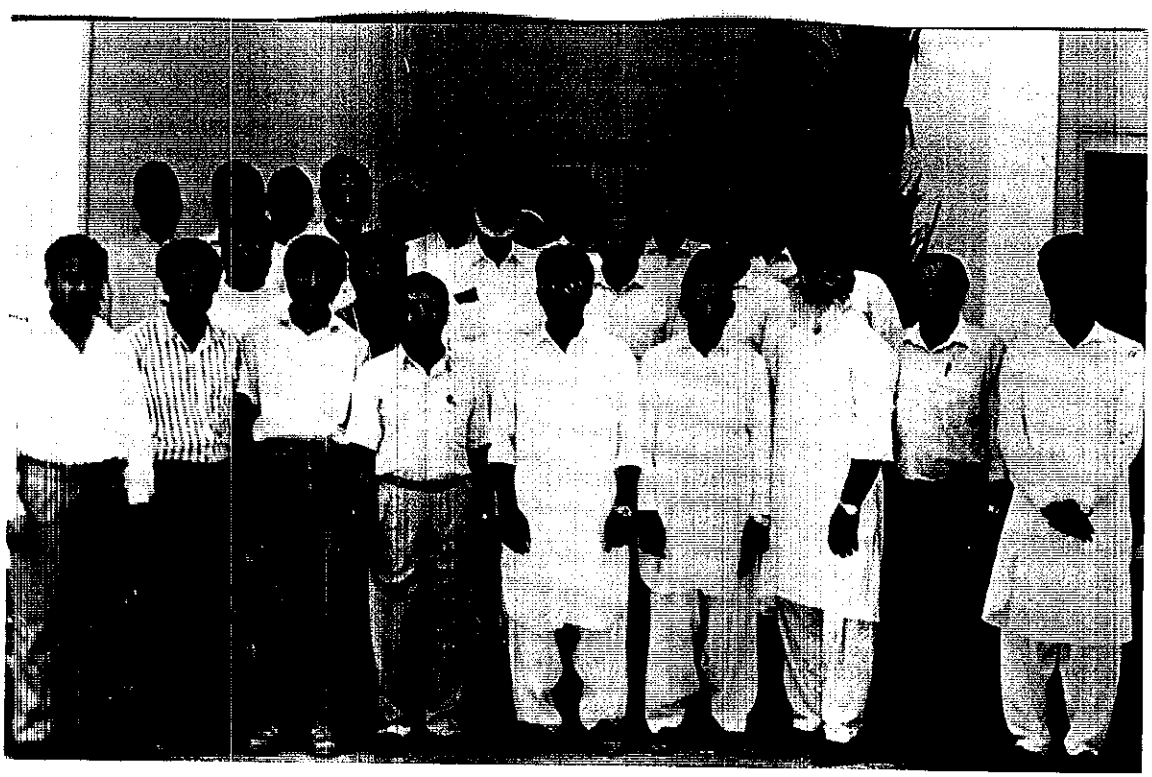
Curriculum and training towards a postgraduate degree in FSR would emphasise quantitative management methods in selected farming systems. Students may enter the FSR postgraduate scheme with an agricultural, livestock, economics or education extension background.

Picture- 26. Dr. Zafar Altaf, Chairman, PARC alongwith private enterpneure visited project areas.

Picture- 27. Delegates are being briefed various On-station activities under FSR.

Picture- 28. Field day programme for training and technology demonstration.

Picture- 29. A group photo of trainees under FSR.



Picture- 30. Certificate distribution ceremony for trained farmers.

Picture- 31. Farmers are happy to get Mott cutting for fodder improvement at a farmer gathering.