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ANNUAL REPORT

(1 September 1990 - 14 July 1991)

The Office of The Science Advisor, US Agency for International Development, Washington, D.C., USA

EXPLOITATION OF GENETIC YIELD POTENTIAL OF COMMON BUCKWHEAT (Fagopyrum esculentum Moench.) ECOTYPES IN DIFFERENT REGIONS OF NEPAL

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Project Number : 10.614 Grant Number: 936-5600.03

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Project Duration: 1 September 1990 to 30 September 1994

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EXECUTIVE SUMMARY:

The buckwheat is one of the staple food crops in high altitude mountains and hills of Nepal. In these regions both tatar or bitter buckwheat (Fagopyrum tataricum) and common buckwheat (Pagopyrum esculentum) have been cultivated from ancient times, and the perennial species of buckwheat (Fagopyrum cymosum) is prevalent to the mountains in a altitudinal range from 1500 to 3000 masl). This indicates that this range comes among the native places of buckwheat.

In Nepal buckwheat is extensively cultivated in moisture-, nutrient-deficient and temperature stress conditions with low inputs (manures and tillage). The farmers have been growing only indigigenous local cultivars with their own seeds - the ecotypes, and the yield level is as low as 600-800 kg/ha. The production and productivity of common buckwheat.

The major task of this project in the 1990/91 fiscal year was to collect indigenous buckwheat germplasm from eastern, western and far-western hills and mountains. Inspite of various managerial constraints arisen from the very beginning of the project three germplasm collection expeditions were organized to meet the objective, and indigenous germplasm comprising 200 accessions has been collected from various buckwheat growing areas in the eastern, western and far-western hills and mountains.

Some Russian materials (nine varieties) were introduced & grown last year. Out of them seven varieties were completely unviable. Some seeds are obtained from the two varieties and preserved for next season planting. Correspondences have also been done for introducing exotic materials from other countries. The NHCRP, Nepal as promised by Dr. K.W. Riley, will provide with Canadian and Japanese materials. American material is expected from NSSL, New York (Dr. James McPherson, USDA-ARS, Reg. Plant Introduction Station, NY State Agri. Exp. Station., Geneva).

The Principal Investigator recently visited Penn State University (24 July to 12 August) and certain improvement in the technical plan of the project has been proposed. The potential for scientific collaboration has also been planned to be explored.

SECTION: 1

A. RESEARCH OBJECTIVES:

Specific objectives of the research project for 1990/91 FY included:

i. to collect indigenous buckwheat germplasm (ecotypes) from the eastern, western and far-western hills and mountains of Nepal;

ii. to visit Penn. State University, USA for improving the technical plan of the project, to explore scientific collaboration for increased productivity of the project, and also to undergo informal training in the usage of modern equipment to interprete yield formation and improvement in buckwheat; and

iii. to procure modern laboratory equipment to strengthen the research capability of the institution.

B. RESEARCH ACCOMPLISHMENTS:

Indigenous buckwheat germplasm is collected from most of the buckwheat growing areas in the eastern, western and-far western hills and mountains. In the course of germplasm collection expedition the buckwheat growers were asked about their concerns, preferences, problems/constraints and expectations regarding buckwheat farming. Majority of the farmers' responses supported the hypothesis and overall objective of the project. The responses of the farmers have been presented as appendix-i.

The place, number of accessions collected and variations in bio-morphological traits have been presented in table-1. Data presented in table-1 reveal that there is wide genetic diversity in the indigenous common buckwheat ecotypes. Observations and measurements were done in the standing crop and in the laboratory.

In the course of germplasm collection expedition the perennial wild buckwheat (Fagopyrum cymosum) was found to be prevalent in some of the mountains and hill sides either as companion plant species to tatar buckwheat or as weed/grazing plant species. It is called variously in different places, e.g. Ban Bhande (in Dolakha), Ban Mande (in Kaski), Bhadbhade (in Baglung)and Phapare jhar (in Taplejung). Prevalence of this wild species of buckwheat in himalayan foot hills of Nepal reveal that this range comes among the native places of buckwheat. Dr. Marshall (personal communication) suggested that search should be made to find out short or intermediate styled flower-type biotypes in the indigneous material for evolving self-fertile lines.

Tahle 1. The places, number of accessions and variations among the buckwheat ecotypes collected from eastern, western and far-western hills and mountains of Nepal.

Region	Places (districts)	Accessions collected 1/	Variation: Flower color	Seed color	Seed size
Eastern	Ilam, Panchthar,	7,14	++	++	++
	Khotang, Bhojpur,	8,8	++	++	++
	Taplejung, Terhathum,	8,9	++	++	++
	Dhankuta,Okhaldhunga,	10,4	++	++	++
	Sankhuwasabha,	2,	+	+	+
	Solukhumbu, Ramechhap,	2,2	NA+	NA+	NA+
	Dolakha	5,	+	+	+
Western	Syangja, Kaski,	5,3,	++	++	++
	Parbat, Arghakhachi,	5,7,	++	++	++
	Gulmi, Baglung,Pyuthan,	11,7,2,	+++	+++	+++
Far-western	Dailekh, Jumla,Kalikot,	8,4,5,	+++	+++	+++
	Achham, Bajura,Salyan,	3,4,5,	+++	+++	+++
	Rukum, Jajarkot,	3,4	++	++	++

+ yes, NA - not available 1/ includes tatar buckwheat also

The collected buckwheat accessions and Dr. Rajbhandari's previous collection and breeding lines have been prepared for field experiments (characterization, evaluation and breeding) in different ecological regions.

C. SCIENTIFIC IMPACT OF COLLABORATION:

The Principal Investigator visited Pennsylvania State University, USA during 24 July to 11 August 1991. He had meetings with Dr. Elwood Hatley, the Collaborator of the project, and other scientists of the Penn. State University, and such issues as technical plan of the project, present research status and future scientific collaboration on buckwheat research program, extension of improved technology anticipated to be generated in the course of this project, and Dr. Hatley's visit to Nepal were discussed. Dr. Rajbhandari presented a seminar on "Buckwheat in Nepal" on 7 August 1991, at Penn State University. Presentation of the seminar that delt with various aspects of hill farming system was highly appreciated by the participants of the seminar. Slides of major areas with soil type, slope, terraces, vegetation and standing buckwheat ecotypes in farmers fields, research field at the Institute of Agriculture & Animal Science, Rampur and selected biotypes with distinct morphological traits (Dr. Rajbhandari's previous work) were shown. It encouraged scientists for planning collaborative activities.

Travel report of the P.I.'s visit to Penn. State University is already submitted. That report deals with scientific collaboration in this project. In that report it has been concluded that Dr. Rajbhandari's meetings with the scientists have opened up new prospects of scientific collaboration. Exploring the potential of biotechnological method to overcome barrier (self-incompatability) in buckwheat breeding may prove to be a break-through in buckwheat improvement. Detail plan for such activity as a part of technical plan of the project will be presented in near future.

Dr. Elwood Hatley's first visit to Nepal has been tentatively planned for late October - early November, 1992.

D. DESCRIPTION OF PROJECT IMPACT:

During the first year period of the project a wide collection of indigenous buckwheat germplasm has been made. These materials will be used in subsequent years as per plan of the project. Some of the materials have been exchanged with National Hill Crops Research Program, HMG, Nepal. Some of Dr. Rajbhandari's breeding lines have also been provided to NHCRP for evaluating in its research sites.

E. STRENGTHENING OF RESEARCH CAPABILITY OF TU:

The Principal Investigator Dr. Rajbhandari recently visited the Penn State University, PA, USA. He had meetings with many scientists to explore the potential of scientific collaboration for increased productivity of the project. He also updated knowledge in the usage of modern equipment such as LICOR portable photo-synthesis measurement system in interpreting yield formation and improvement in buckwheat. He also visited laboratories relevant to the project work-plan.

Some of the modern equipment have already been requested to be procurred by USAID/Nepal, and expected to be available to the project upto mid-September. This would improve and strengthen the capability of the institution to conduct this and similar biological researches.

The project had to face unfavourable administrative burden in the past as mentioned in the last management report, and continuous efforts were made to overcome those constraints. As a result the Office of Vice-Chancellor, Tribhuvan University has permitted to conduct the research project under the Research Centre for Applies Science & Technology, Tribhuvan University,

Kathmandu from this 1991/92 fiscal year onward. This would also facilitate bio-chemical analyses of the seeds, soil tests, timely contact and co-operation with USAID/Kathmandu, Nepal, and cooperation with the NHCRP, Kathmandu. Field experiments to be conducted in Kathmandu research site (at RECAST, Kathmandu) would be efficiently & regularly observed, laboratory analyses be conducted at RECAST. AT RECAST the Principal Investigator will have no other responsibilities except conducting research and relevant work, and therefore, the project productivity will obviously be higher.

F. FUTURE WORK:

Most of the indigenous buckwheat germplasm from the hills and mountains of eastern, western and far-western regions has already been collected and in this year germplasm from central region (hills/mountains) is planned to be collected. The so-far collected germplasm will be grown in different ecological sites for characterization, evaluation and breeding work. Parallel to this the seeds of these accessions will also be multiplied.

So far the project is on schedule, and substantial changes in the work-plan of the project have not been made. Based on Dr. Rajbhandari's discussions with Dr. Hatley, Dr. H.G. Marshall and Dr. C. Boyer at Penn State University, PA, improvement of the technical plan has been planned for future. This includes such activities as development of genotypes based on pure lines and pollen-culture. The later approach is expected to be efficient in overcoming the barrier (self-incompatability) in buckwheat breeding. These breeding activities will be conducted in cooperation with Dr. Marshall and Dr. Boyer. Breeding work based on pollen culture would be conducted at Penn State University and for this Dr. Rajbhandari would spent the period (about four months) in Penn State University. Dr. Boyer, Prof.

Plant Breeding and Genetics has agreed to collaborate in this activity. A detail plan to address this activity and the budgetary requirement will be presented to USAID, Washington, D.C. in near future. It is hoped that this improvement as supplement to the project will be approved by USAID/SCI.

Evaluation of buckwheat germplasm (ecotypes) in this year is planned for Kathmandu (RECAST), Chitwan (IAAS), Lamjung (Lamjung Campus) and Jumla (Farmer's field) representing four geo-ecological environments.

SECTION: 2

A. MANAGERIAL ISSUES:

As mentioned above the project had to face unfavourable administrative burden in the past and as a result of P.I.'s effort the Office of Vice-Chancellor, Tribhuvan University has permitted to conduct the research project under the Research Centre for Applied Science & Technology (RECAST), Tribhuvan University, Kathmandu from this 1991/92 Fiscal Year onward.

The project would have research sites at Kathmandu (RECAST), Chitwan (IAAS), Lamjung (Lamjung Campus), Jumla (Farmer's field) and Mustang (Farmer's field) as proposed in the management report.

B. BUDGET:

The expenditures under different line items have been presented in the Final Statement of Expenditure of the project which is presented in this report as appendix ii.

The excess expenditure within the approved budget is requested to be reimbursement from the USAID, Nepal.

C. SPECIAL CONCERNS:

There has not been any changes in the protocols which address special concerns.

D. COLLABORATION, TRAVEL, TRAINING AND PUBLICATION:

During the last six months two germplasm collection expeditions were organized to the western and far-western hill districts, and indigenous buckwheat ecotypes were collected. These expeditions covered such districts as Kaski, Syangja, Arghakhanchi, Gulmi, Parbat, Baglung, Rukum, Achham and Bajura, etc.

The Principal Investigator visited Penn. State University for two weeks (24 July to 11 August). This visit was in relation to the improvement of Technical part of the project, to update knowledge in the usage of modern equipment in interpreting buckwheat yield formation and breeding.

P.I.'s meetings with many scientists of College of Agriculture, Penn State University helped to improve the technical plan as well as to explore the potential for scientific collaboration. In near future collaborative activities in using pollen culture as a means of overcome barrier in buckwheat breeding is supposed to be started in cooperation with Dr. Charles Boyer.

Meeting with Dr. Hatley strenghthened the collaboration in the project activity. Issues regarding technology generation, extension and future works as continuation of the project activity in higher level were discussed. Dr. Hatley's visit to Nepal for evaluating the field works and making relevant suggestions/recommendations is planned for late October-early November, 1992.

In the next six months field experiments will be conducted at Kathmandu, Chitwan (Rampur), Lamjung and Jumla ecological sites. One germplasm expedition will be organized in November to collect buckwheat ecotypes from the hill districts of the central region.

So far project publications have not been appeared, one paper based on germplasm diversity is being prepared for publication.

Dr. B.P. Rajbhandari is supposed to participate in the Biotechnology 2000 conference and "networking" meeting to be held at Bali, Indonesia from 16-21 September, 1991. This travel and participation in the conference and meeting is sponsored by BOSTID, Washington, D.C.

E. REQUEST FOR AID OR BOSTID ACTION:

The USAID, Washington, DC may help increase the project productivity by approving the technical plan (as supplement to what was planned) of the project. A detail plan of this activity will be submitted in near future, as it is being developed in cooperation with Dr. C. Boyer.

Dr. Rajbhandari is invited to participate in the "23rd, International Seed Testing Congress", to be held October 28 through November 7, 1992 in Argentina. He will present a paper on the materials of the buckwheat research project. The tentative topic of the paper would be "Seed fertility in common buckwheat ecotypes as influenced by geo-ecological conditions". The BOSTID is requested hereby to sponsor this travel (registration and per diem to include hotel and meal costs). I hope that this technical assistance if provided by the BOSTID, will provide with a chance to discuss international collaboration as well as the delivery of research efforts funded by USAID/PSTC.

ANNEX. i

EASTERN HILLY REGION:

A. District: DHANKUTA Headquarter: Dhankuta Bazar

a. Population: 129,781
b. Cultivated area: 14,700 ha
c. Area under buckwheat: about 275 ha
d. Rainfall: 802.6 mm/yr
e. Temperature: 15.4-21.5°C
f. Elevation: 609-2438 masl

B. Sites visited: Ramche, Dadakharka, Pewang, Tilke, Phalante, Phawa.

C. Expedition route: Biratnagar = Dhankuta = Pakhribas - - Ramche - Dadakharka - Phewang - Ghorlikharka - Phalante - Phawakhet - Pakhribas = Itahari (Sunsari district).

= by bus - trekking

D. Despcription of location:

SN	Name of location	Altitude (masl)	Distance form HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Ramche	1675	12	sandy loam	No	livestock
2	Dandakharka	1450	14	"	No	livestock
3	Phewang	1200	20	"	No	Bamboo works
4	Tilke	1250	28	"	No	livestock
5	Phalante	1200	30	"	No	livestock
6	Phawakhet	1100	15	"	No	livestock

E. Total number of samples collected: nine

F. Existing cropping patterns including buckwheat:

a. maize/buckwheat - fallow
b. maize - buckwheat
c. maize+raddish/buckwheat (after harvest of maize)

d. maize/finger millet - buckwheat
e. finger millet (seed bed) - buckwheat

G. Buckwheat cultivation:

a. Cultivation: marginal upland (without irrigation)
b. Productivity (kg/ha): 700-900
c. Production (ton/yr): 180-240
d. Type of cultivar: only landraces

H. Morphological variations:

a. Seed size: medium
b. Seed colour: grey/brown/black
c. Seed shape: triangular
d. Flower colour: pink/white
e. Crop duration: 70-90 days
f. Growth habit: indeterminate

I. Market:

Price in local market.

(a) Seed: Rs. 25/kg (b) Grian: Rs. 20/kg

J. Growers' remarks:

a. No improved varieties
b. Low seed set
c. Lack of assured marketing facility
d. No improved technology
e. No irrigation facility

K. Remarks:

In Phewang buckwheat is grown as catch crop.

L. Utilization:

Bread (roti), phulaura, and porridge. Holly food during religious fasting.

ANNEX. i

A. District: ILAM Headquarter: Ilam Bazar

a. Population: 178,356
b. Cultivated area: 20,100ha
c. Area under buckwheat: 200 ha
d. Rainfall: 13297 mm/yr
e. Temp.: 12.7-21.8°C
f. Elevation: 610-3679masl

B. Sites visited:

Phikal (ward Number 3 and 5), Romphok, Ilam Bazar, Golakharka, Sakhejung

C. Expedition route:

Itahari = Phikal - 3 - Phikal-5 = Ilam Bazar - Romphok- = Golakharka = Sakhejung

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ KM	Soil type	Irrigation	Integrated enterprises
1	Phikal-3	1450	15	Sandy loam	No	Tea farming & processing
2	Phikal-5	1410	15	Loam	Available	"
3	Romphok	1400	17	loam	"	"
4	Ilam Bazar	1000	-	sandy loam	"	"
5	Golakharka	900	2	"	No	"
6	Sakhejung	1440	8	"	No	"

E. Total number of samples collected: seven

F. Existing cropping patterns including buckwheat:

a. rice - wheat or buckwheat (in low land)
b. rice-buckwheat-rice (in low land)
c. maize-buckwheat (in up land)
d. maize/finger millet-buckwheat (in up land)

G. Buckwheat cultivation:

a. Cultivation: both in up land and low land
b. Productivity (kg/ha): 600 - 800
c. Production (ton/yr): 140
d. Type of cultivate: local landrace

H. Morphological variations:

a. Seed size: medium
b. Seed shape: grey /black
c. Seed shape: triangular (winged and quadra-or pentamarginal)
d. Flower colour: pink/red
e. Crop duration: 60-90 days after sowing
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 35/kg (b) Grian Rs. 20/kg.

J. Growers' remarks:

a. Low seed set
b. Scarcity of seed during planting time
c. Lack of assured marketing facility
d. No improved varieties
e. No improved production technology

K. Remarks/Utilization:

In this district buckwheat is grown both in rice based and maize based cropping systems. In rice based system the buckwheat is sown in Falgun (March/April) and harvested prior to rice plantation (June/July). Tamang community prefer buckwheat bread (chapati) than that of wheat. Brahman and Chhetri community prefer wheat, however they grow buckwheat and use during religious fasting.

ANNEX.i

A. District: PANCHTHAR HQ: Phidim

a. Population: 153,746
b. Cultivated area: 14,995 ha
c. Area under buckwheat: 300 ha
d. Rainfall: 2289.9 mm/yr
e. Temperature: 15-22°C
f. Elevation: 609-3675 masl

B. Sites visited:

Yasok - Dada Gaon, Rani Gaon, Lalikharka, Ranitar

C. Expedition route:

Sakhejung (Ilam) = Phidim - Yasok - Dada Gaon - Phidim - Lalikharka - Ranitar - Phidim = Gophetar - Amarpur-Kabeli

D. Description of location:

SN.	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	irragation	Integrated enterprises
1	Yasok	1300	21	Red soil	No	Livestock
2	Dada Gaon	1435	22	Sandy loam	No	"
3	"	1500	22	Clay loam	No	"
4	"	1550	23	"	No	"
5	Rani Gaon	1525	22	Sandy loam	No	Bamboo works & carpet industry
6	Lalikharka	2000	3	"	No	Livestock
7	"	2100	3.5	Clay loam	No	"
8	Ranitar	2400	5	Sandy loam	No	"

E. Total number of samples collected: ten

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. rice-buckwheat-fallow
c. rice-wheat+buckwheat

G. Buckwheat cultivation:

a. Cultivation: Rice based and maize based dry farming systems
b. Productivity (kg/ha): 700-900 kg/ha
c. Production (ton/yr): 240
d. Type of cultivat: local landrace (ecotype) "Baramase" "Mangsire". Baramase is early by 10-15 days.

H. Morphological variations:

a. Seed size: small and medium
b. Seed colour: greyish black/brown
c. Seed shape: triangular (mixture of winged types)
d. Flower colour: White/pink
e. Crop duration: 60-90 days
f. Growth habit: indeterminate

I. Market:

Price in local market.

(a) Seeds Rs. 8/kg (b) Grian Rs. 5/kg

J. Growers' remarks:

a. It is grown mainly for household consumption
b. Lack of marketing facility
c. Low seed set particularly when the moisture is deficient
d. No improved cultivar, no fertilizers available
e. They grow tatar and common buckwheat. Prefer the common buckwheat because they feel that it improves health and vigour.

K. Remarks/Utilization:

The Rai, Tamang and Shrestha ethnical communities prefer buckwheat bread regarding it as more tasty, soft and useful for health. Some household make beverage (Janda) out of buckwheat. But usually it is used to make bread, phulaura, pan cake. The straw is used to feed cattle or as bedding materials.

ANNEX. i

A. District: TAPLEJUNG HQ: Phungling Bazar

a. Population: 120780 d. Rainfall: 1933 mm/yr

b. Cultivated area: 10000 ha e. Temperature: 12-21°C

c. Area under buckwheat: 320 ha f. Elevation: 777-8598 masl

B. Sites visited:

Hangdewa, Dokhu, Namle, Giri Gaon, Nangkholang

C. Expedition route:

Kabeli Khola - Phungling Bazar - Hangdewa - Dokhu - Namle - Giri Gaon - Nangkholang - Kharkula

D. Description of location:

SN.	Name of location	Altitude (masl)	Distance from HQ (Km)	Soil type	Irrigation	Integrated enterprises
1	Hangdewar	1815	2	Clay loam	No	Livestock
2	"	1700	2.5	Sandy loam	No	"
3	Dokhu	NA	2	"	No	"
4	Namle	NA	2.5	"	No	"
5	Giri Gaon	NA	3	"	No	"
6	Nangkholan	NA	4	"	No	"

E. Total number of samples collected: eight

F. Existing cropping patterns including buckwheat:

a. rice - buckwheat

b. maize - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland and low land (dry farming system)
b. Productivity (kg/ha): 800 - 900 kg/ha
c. Production (ton/yr): 250 - 270
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: medium and large size
b. Seed colour: grey/greyish black/brown
c. Seed shape: traingular (mixture of winged types)
d. Flower colour: red/pink
e. Crop duration: 70-90 days after sowing
f. Growth habit: predominantly indeterminate

I. Market:

Price in local market

(a) Seed Rs. 15/kg (b) Grian Rs. 10/kg.

J. Growers' remarks:

a. Scarcity of seed during planting time
b. not familiar with improved production technology
c. lack of assured market
d. second important crop after potato
e. need high yielding varieties with better seed set

K. Remarks/utilization:

Farmers frequently grow buckwheat as catch crop. Buckwheat bread is regarded to be better than that of wheat. Fluctuation in yield is particularly due to availability of moisture. Some households use buckwheat to prepare beverage (Jand)

ANNEX. i

A. District: TERHATHUM HQ: Myanglung Bazar

a. Population: 92459
b. Cultivated area: 13000 ha
c. Area under buckwheat: 250 ha
d. Rainfall: 1250 mm/yr
e. Temperature: 15-30°C
f. Elevation: 345-3962 masl

B. Sites visited:

Hawku, Limba, Sankranti Bazar, Isubu, Solma,

C. Expedition route:

Hawku - Limba - Sankranti Bazar - Isubu - Myanglung - Lasune - Basantpur

D. Description of location:

SN.	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Hawku	1650	20	Sandy loam	No	Livestock
2	Liamba	NA	15	"	No	"
3	Isubu	NA	10	"	No	"
4	Thapagaon	NA	9	"	No	"
5	Isubu	NA	8	Clay loam	Available	Livestock
6	Solma	1150	4	"	"	"

E. Total number of samples collected: seven

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. rice - buckwheat
c. rice - wheat + buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland maize and rice field (rainfed)
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 180-200
d. Type of cultivat: only local ecotype

H. Morphological variations:

a. Seed size: small/medium sized
b. Seed colour: greyish black/brown/black
c. Seed shpae: traingular
d. Flower colour: pink/white
e. Crop duration: 70-90 days
f. Growth habit: predominantly indeterminate

I. Market:

Price in local market

(a) Seeds Rs. 12/kg (b) Grian Rs. 8/kg

J. Growers' remarks:

a. Low seed set, particularly during dry year
b. Lack of marketing facility
c. Lack of improved varieties
d. Not familiar with improved technology of production
e. Prefer buckwheat bread as compared to millet and maize

K. Utilization:

Buckwheat in Terhathum is utilized mainly to make breads. Some of the households even make beverage out of it. The straw is used to feed cattle, bedding material and also for cooking (as supplement to fuel wood).

ANNEX. i

A. District: SANKHUWASABHA HQ. Khandbari

a. Population: 29414
b. Cultivated area: 9000 ha
c. Area under buckwheat: 110 ha
d. Rainfall: 1141mm/yr
e. Temperature: 7-29°C
f. Elevation: 345-8470 masl

B. Sites visited:

Mure, Mamling

C. Expedition route:

Basantpur (Terhathum) - Mure - Mamling - Chainpur - Tumlingtar

D. Description of location:

SN.	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Mure	1800	21	Sandy loam	No	Livestock
2	Mamling	1600	20	"	No	Livestock

E. Total number of samples collected: two

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. maize + soybean - buckwheat

G. Buckwheat cultivation:

a. Cultivation: marginal upland (rainfed)
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 80-90
d. Type of cultivat: only local cultivar (ecotype)

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/brown/silver hull
c. Seed shape: triangular
d. Flower colour: pink/white/red
e. Crop duration: 70-90 days after sowing
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 12/kg (b) Grian Rs. 8/kg

J. Grower's remarks:

a. Not familiar with improved technology
b. No improved cultivars
c. Lack of marketing facility
d. Lower yield in the absence of rainfall
e. It is an important crop during religious fasting, for cultivation in poor lands, and also as catch crop. The seed has better price.

K. Remarks/Utilization:

It is common as in other eastern parts of the country.

ANNEX. i

A. District: BHOJPUR HQ: Bhojpur Bazar

a. Population: 192689
b. Cultivated Area: 16200 ha
c. Area under buckwheat: 185 ha
d. Rainfall: 1208.6 mm/yr
e. Temp.:13.5-20.5°C
f. Elevation:152-7320 masl

B. Sites visited:

Bhojpur Bazar, Dawa, Gupteshwor, Annapurna, Sanyasi Gaon

C. Expedition route:

Tumlingtar (Sankhuwasabha) - Champa - Bhojpur Bazar - Dawa - Gupteshwor - Annapurna - Sanyasi Gaon - Nirmali Dada(Khotang)

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Gupteshwor	1700	5	Sandy loam	No	Livestock
2	Annapurna	1750	7	"	No	"

E. Total Number of samples collected: two

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - fallow
b. maize+soyabean - buckwheat
c. rice - buckwheat + wheat
d. buckwheat - rice - wheat

G. Buckwheat cultivation:

a. Cultivation: Rainfed upland and lowland
b. Productivity (kg/ha): 800-900
c. Production (ton/yr): 148-167
d. Type of cultivar: only local ecotypes

H. Morphological variations:

a. Seed size: medium/large
b. Seed colour: grey/brown/silver-hull
c. Seed shape: triangular smooth edges
d. Flower colour: white/light pink
e. Crop duration: 80-90 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 15/kg (b) Grian Rs. 10/kg

J. Grower's remarks:

a. Only local cultivars are available. Need improved cultivars.
b. Lower seed set when rainfall does not occur during seed formation.
c. Not familiar with improved cultivation technology.
d. Use manure when grown in rice field prior to rice plantation.
e. In maize field manure is applied only in maize.

ANNEX. i

A. District: KHOTANG HQ: Diktel

a. Population: 247167
b. Cultivated area: 9460 ha
c. Area under buckwheat: 375 ha
d. Rainfall: 1305 mm/yr
e. Temp.: 13.4-19.9°C
f. Elevation: 152-3620masl

B. Sites visited:

Nirmali dada - Bisauna, Rabuwa, Lami dada

C. Expedition route:

Nirmali dada - Dobela - Diktel - Bisauna - Lami dada - Rabuwa

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Nirmali dada (Lamakhu)	-	20	Clay loam	No	Livestock
2	Bisauna (Chihand dada)	-	3	Sandy loam	No	"
3	Rabuwa	-	7	Clay loam	No	"
4.	Lami dada	1128	4	Clay loam (red soil)	No	"

E. Total number of samples collected: six

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. maize + soyabean - buckwheat
c. rice - buckwheat + wheat
d. buckwheat - rice - wheat

G. Buckwheat cultivation:

a. Cultivation: rainfed upland and lowland
b. Productivity (kg/ha): 800-900
c. Production (ton/yr): 300-340
d. Type of cultivat: local landrace

H. Morphological variations:

a. Seed size: small/medium/large
b. Seed colour: greyish black/black/brown
c. Seed shape: triangular (winged/rounded edges)
d. Flower colour: white/pink/red
e. Crop duration: 70 - 90 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seeds Rs. 15/kg (b) Grian Rs. 10/kg

J. Growers' remarks:

a. Lower seed set, particularly if suffers from moisture stress.
b. Lack of assured market. Farmers use to go to Diktel bazar for selling buckwheat (seed as well as grain)
c. Not familiar with improved production technology.
d. Need improved variety.
e. Prefer buckwheat bread than that of millet.

ANNEX. i

A. District: OKHALDHUNGA HQ: Okhaldhunga Bazar

a. Population: 137640
b. Cultivated area: 8600 ha
c. Area under buckwheat: 150 ha
d. Rainfall: 2025 mm/yr
e. Temp.: 11-20.21^{0}C
f. Elevation: 350-3330 masl

B. Sites visited:

Giri gaon, Okhaldhunga Bazar, Patale

C. Expedition route:

Rabuwa - Okhaldhunga Bazar - Patale - Solu Salleri

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Giri Gaon	1760	10	Sandy loam	No	Livestock
2	Okhaldhunga	1849	-	"	No	"

E. Total number of samples collected: four

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. maize+beans - buckwheat
c. maize+soyabean - buckwheat+mustard
d. buckwheat - rice - wheat
e. rice - barley+buckwheat

G. Buckwheat cultivation:

a. Cultivation: rainfed upland/low land (upland rice field)
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 100-120
d. Type of cultivat: local landrace

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour; greyish black/silver-hull
c. Seed shape: triangular (winged and rounded edges)
d. Flower colour: pink/white
e. Cropduration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 15/kg (b) Grian Rs. 10/kg

J. Growers' remarks:

a. Need improved cultivars
b. Lack of assured market
c. Not familiar with improved cultural practices
d. Generally suffer from moisture deficiency during post rainy season planting
e. Manure is not applied in buckwheat field.

ANNEX. i

A. District: RAMECHHAP HQ: Ramechhap

a. Population: 161445
b. Cultivated area: 12500 ha
c. Area under buckwheat: 150 ha
d. Rainfall: 2025 mm/yr
e. Temp.: 12-21^{O}C
f. Elevation:1000-4848masl

B. Sites visited:

Chedadung, Kinja

C. Expedition route:

Solu Salleri (Solukhumbu district) - Chedadung - Kinja-Jiri

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Chedadung	1200	35	Sandy loam	No	Livestock

E. Total number of samples collected: two

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. maize + beans- buckwheat
c. maize/millet - buckwheat + mustard or rape seed

G. Buckwheat cultivation:

a. Cultivation: marginal land
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 100-1120
d. Type of cultivat: only local landraces

H. Morphological variations:

a. Seed size: medium/large
b. Seed colour: greyish black/silver-hull
c. Seed shpae: triangular
d. Flower colour: pink/white
e. Crop duration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 16/kg (b) Grian Rs. 12/kg.

J. Growers' remarks:

a. Low yields of the local cultivar
b. Need improved varieties
c. Lack of marketing facility
d. Lack of knowledge about improved production technology
e. Important food crop during religious fasting, for snacks and in view of multiple utility.

ANNEX. i

WESTERN REGION:

A. District: GULMI HQ: Tamghas

a. Population: 238113
b. Cultivated area: 31468 ha
c. Area under buckwheat: 275 ha
d. Rainfall:1516.6 mm/yr
e. Temp.:14.8-23.3°C
f. Elevation:610-3050 masl

B. Sites visited:

Berdukharka, Urleni, Dubichaur, Morahi, Vhanvana, Rajestal, Bastu, Bulma, Tamghas, Purkot Daha

C. Expedition route:

Rampur = Narayan Ghat = Butwal = Tansen = Ridi = Tamghas (Gulmi)- Urleni - Berdukharka - Dubichaur - Morahi (Simichaur) - Arghatoush (Arghakhachi district) -

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ	Soil type	Irrigation	Integrated enterprises
1	Purkot daha	NA		Calcarious white soil	No	Livestock
2	Tamghas	2000		Loam	No	"
3	Berdukharka	NA		Red soil	No	"
4	Bulma	NA		"	No	"
5	Bastu	NA		"	No	"
6	Rejestal	NA		Grey soil	No	"
7	Vhanvane	NA		Calcarious grey soil	No	"
8	Berdukharka	NA		Loam	No	"
9	Urleni	NA		Clay loam (red soil)	No	"
10	Korahi			Loam	No	"

E. Total number of samples collected: eleven

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - follow
b. maize+beans-buckwheat
c. buckwheat - barley or potato

G. Buckwheat cultivation:

a. Cultivation: marginal upland
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 190-220
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/mottled brown
c. Seed shape: triangilar (concave and convex)
d. Flower colour: pink/red/white
e. Crop duration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 15/kg (b) Grian Rs. 10/kg

J. Growers' remarks:

a. Lack of assured marketing facility
b. Lack of seed during planting time
c. Lower yield due to unavailability of water (irrigation)
d. Not familiar with improved production technology
e. Need improved high yielding cultivars

K. Utilization/Remarks:

As in other parts of Nepalese hills/mountain in Gulmi also buckwheat is used to make bread and phulaura and porridge. Urleni (Dubichaur Village Development Committee) and Morahi (Simichaur VDC) are the important buckwheat growing areas of this district. In this district buckwheat substitute finger millet in poor lands.

ANNEX. i

A. District: ARGHAKHANCHI HQ: Sandhikharka (Chutra Besi)

a. Population: 157305
b. Cultivated area: 24224 ha
c. Area under buckwheat: 350 ha
d. Rainfall: 849.5 mm/yr
e. Temp.: NA
f. Elevation: 305-2515 masl

B. Sites visited:

Dharam Pani, Nuwakot, Bardabas, Khildi, Chide Pani, Baraudi

C. Expedition route:

Semichaur (Gulmi) - Arghatoush - Badla - Sandkharka - Bhadrikhola - Nuwakot - Khildi - Asurkot

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Dharampani	NA		Calcarious (black soil)	No	Livestock
2	Nuwakot	NA		Red soil	No	"
3	Bardibas	NA		White soil (sandy clay)	No	"
4	Khildi	NA		Calcarious (grey)	No	"
5	Chide Pani	NA		Red soil	No	"
6	Baraudi	NA		"	No	"
7	Khildi	NA		"	No	"

E. Total number of samples collected: seven

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - fallow
b. buckwheat - rice - wheat

G. Buckwheat cultivation:

a. Cultivation: upland (maize and rice based systems) rainfed
b. Productivity (kg/ha.): 800 -900
c. Production (ton/yr): 280 - 315
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium/large
b. Seed colour: greyish black/mottled brown/silver-hull
c. Seed shape: triangula (winged and rounded edges)
d. Flower colour: light pink/pink/red
e. Crop duration: 80 - 100 days
f. Growth habit: predominantly indeterminate

I. Market:

Price in local market

(a) Seeds Rs. 15/kg (b) Grian Rs. 10/kg

J. Growers' remarks:

a. Lack of market
b. Low yield due to shortage of water for irrigation
c. Buckwheat is exported to other districts and India
d. Farmers exchange buckwheat with hulled rice on equal proportion.
e. Newly cultivated slopy lands are used primarily for buckwheat cultivation.

K. Utilization/Remarks:

It is used in similar ways as in other hilly districts. The farmers have classified buckwheat into four types: i. Bhalu Tite (black seeded tatar buckwheat) - it is very bitter in taste; ii. Rani Tite (grey seeded tatar buckwheat) - it is relatively less bitter; iii. Small seeded common buckwheat - it is less vigourous in growth; and iv. Large seeded common buckwheat - the plants are more vigourous and mature late.

ANNEX. i

A. District: PYUTHAN HQ: Khalanga

a. Population: 192390
b. Cultivated area: 28300 ha
c. Area under buckwheat: 250 ha
d. Rainfall: 1350 mm/yr
e. Temp.: 14-23°C
f. Elevation: 305-3659 masl

B. Sites visited:

Dharampani, Khalanga, Lammale, Nepane, Okharkot, Badikot

C. Expedition route:

Asurkot - Chujathati - Tallo Banchare (Dharampani) - Banchare - Khalanga - Lamidada - Lammala - Bijuwar - Machchhi - Okharkot - Badikot - Patauti - Purkot - Bastu

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Intergrated enterprises
1	Lammala-5	NA	-	Grey (calcarious)	No	Livestock
2	Badikot	NA	-	"	No	"
3	Dharampani	NA	6	Sandy loam	No	"
4	Khalanga	1370	-	red soil	No	"
5	Nepane	NA	-	Grey soil (calcareous)	"	"
6	Okharkot	NA	20	"	"	Livestock and bamboo works

E. Total number of samples collected: seven

F. Existing cropping patterns including buckwheat:

a. maize+soyabean - buckwheat
b. buckwheat - fallow

The crop rotation followed in highly slopy land is:
First year: Buckwheat - fallow
Second year: Fallow - fallow
Third year : Buckwheat - fallow, so on.

G. Buckwheat cultivation:

a. Cultivation: upland, marginal lands (slopy)
b. Productivity (kg/ha): 800-900
c. Production (ton/yr): 200-220
d. Type of cultivat: only local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: dark brown/greyish black/mottled brown
c. Seed shape: Triangular (winged, rounded edges with concave and convex sides)
d. Flower colour: light pink/pink/red
e. Crop duration: 80-100 days
f. Growth habit: predominate indeterminate types

I. Market:

Price in local market

(a) Seed Rs. 12-15/kg (b) Grian Rs. 10-12/kg

J. Growers' remarks:

a. Lack of assured marketing facility
b. Unfamiliar with improved technology
c. Need high yielding varieties
d. Buckwheat is grown through the district
e. Prefer buckwheat bread as compared to millet

K. Utilization/Remarks:

Buckwheat is utilized in similar ways as in other part of hills. In Pyuthan district, Okharkot, Badikot, Lammala and Nepane are major buckwheat growing areas. The farmers are interested to grow more buckwheat if there will be assured marketing facility for their produce.

ANNEX. i

A. District: BAGLUNG HQ. Baglung Bazar

a. Population: 215228
b. Cultivated area: 32498 ha
c. Area under buckwheat: 128 ha
d. Rainfall: 1100 mm/yr
e. Temp.: 14-22°C
f. Elevation:1000-7244 masl

B. Sites visited:

Bastu - Arjaya - Paudiamarai - Baglungbhing - Khal - Burtibang - Bhingkhal - Khar - Kharbang - Galkot hatiya - Narethati - Mulpani - Baglung Bazar

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Intergrated enterprises
1	Salamkot	-	-	red soil	No	Livestock
2	Burtibang	-	-	loam	No	"
3	Narethati	-	-	red soil	No	"
4	Binhudahapani	-	-	grey soil (calcareous)	No	"
5	Bharbatar	-	-	red soil	No	"

E. Total number of samples collected: seven

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - wheat (upland)
b. rice - buckwheat - maize (low land)
c. buckwheat - rice - wheat (low land)

G. Buckwheat cultivation:

a. Cultivation: upland and low land (maize & rice based systems)
b. Productivity (kg/ha): 800-900
c. Production (ton/yr): 100-115
d. Type of cultivat: landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: Greyish black/brown
c. Seed shape: triangular
d. Flower colour: pink/light pink
e. Crop duration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 15-18/kg (b) Grian Rs. 12-14/kg

J. Growers' remarks:

a. lack of assured market for buckwheat
b. Need improved cultivars
c. Not familiar with improved production technology
d. The buckwheat is used as vegetable also
e. It is a good catch crop
f. The crop is grown for home consumption.

K. Remarks:

Dhor Patan and Burtibang are the important buckwheat areas in this district. In the coastal side of the Badiyar khola along the Burtibang side buckwheat is widely grown in rice based system in low lands. In this region the crop is grown throughout the year.

ANNEX. i

A. District: PARBAT HQ: Kusma

a. population: 128400
b. Cultivated area: 19244 ha
c. Area under buckwheat: 150 ha
d. Rainfall: 1300 mm/yr
e. Temp.: 14-26°C
f. Elevation: 762-8091masl

B. Sites visited:

Dhairing, Kim, Deurali, Salija

C. Expedition route:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1.	Dhairing	-	-	Grey (calcarious)	No	Livestock
2	Kim	-	-	Black fertile	No	"
3	Deurali	-	-	clay loam	No	"
4	Salija	-	-	Grey (fertile)	No	"
5	Deurali-1	-	-	Black(fertile)	No	"

E. Total number of samples collected: five

F. Existing cropping patterns including buckwheat:

a. maize/buckwheat - fallow
b. maize - buckwheat - fallow
c. maize/buckwheat - wheat

G. Buckwheat cultivation:

a. Cultivation: upland and low land (maize based system)
b. Productivity (kg/ha): 800 -900
c. Production (ton/yr.): 120 - 140
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/meium
b. Seed colour: brown/greyish black
c. Seed shape: triangular (admixtures: winged, rounded edges)
d. Flower colour: pink/light pink
e. Crop duration: 90 - 100
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 8 - 10/kg (b) Grian Rs. 5-8/kg

J. Growers' remarks:

a. Unavailability of chemical fertilizers.
b. Lack of assured marketing facility.
c. Need improved varieties.
d. Buckwheat is grown as vegetable crop in association with maize.
e. Unfamiliar with improved production technology.

K. Remarks/utilization:

The wild perennial buckwheat (cymosum) occur naturally in higher altitudes of the district. It is locally called "Banmade". This plant species is utilized for grazing the cattle.

ANNEX. i

A. District: KASKI HQ: Pokhara

a. Population: 221272
b. Cultivated area: 37021 ha
c. Area under buckwheat: 102 ha
d. Rainfall: 3880.3 mm/yr
e. Temp.: 15.9-26.1°C
f. Elevation: 450-7939masl

B. Sites visited:

Lumle, Pokhara-16, Pumdi Bhumdi, Nau dada

C. Expedition route:

Deopur (Parbat) - Nayapool - Dhawa - Lumle - Phedi - Nau dada - Pokhara - Pumdi Bhumdi

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Pokhara-16	400	-	sandy loam	No	Livestock
2	Pumdi Bhumdi	720	8	red soil	No	Livestock
3	Lumle	1400	22	calcareous grey soil	No	Livestock

E. Total number of samples collected: three

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - fallow
b. maize/buckwheat (as green vegetable) - wheat or barley

G. Buckwheat cultivation:

a. Cultivation: upland
b. Productivity (kg/ha): 700-800
c. Production (ton/yr): 70-80
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: brown/dark brown
c. Seed shape: triangular with smooth sides
d. Flower colour: light pink/pink
e. crop duration: 90 - 100
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 10-15/kg (b) Grian Rs. 8-10/kg

J. Growers' remarks:

a. Lack of assured market for buckwheat
b. The local cultivars are low yielding, therefore improved varieties needed.
c. Unfamiliar with improved cultural practices
d. Buckwheat is more popular as vegetable crop in this district.
e. Farmers are interested to grow more buckwheat if there would be improved varieties, technology and assured marketing facility.

ANNEX. i

A. District: SYANGJA HQ: Syangja Bazar

a. Population: 354636
b. Cultivated area: 42288 ha
c. Area under buckwheat:200 ha
d. Rainfall: 26.5 mm/yr
e. Temp.: 9.5-28.3^{0}C
f. Elevation:366-2512 masl

B. Sites visited:

Walling - Chandikalika - Ganeshpur - Pekhubagkhor

C. Expedition route:

Pokhara = Syangja = Walling - Sirsekot - Perubag - Bhiutari - Satuparel - Syangja = Pokhara - Pardi - Batule chaur - Tanhu - Dimre = Narayanghat = Rampur

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (Km)	Soil type	Irrigation	Integrated enterprises
1	Walling	-	25	Grey soil	No	Livestock
2	Chandikalika	-	2	"	No	Livestock
3	Ganeshpur	-	9	"	No	"
4	Pekhubagkhor	-	-	sandy loam	available	"

E. Total number of samples collected: five

F. Existing cropping patterns including buckwheat:

a. maize/buckwheat - fallow
b. maize - buckwheat
c. maize/buckwheat - wheat
d. maize+soyabean - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland
b. Productivity (kg/ha): 700 - 800
c. Production (ton/yr): 140 - 169
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: brown/dark brown/greyish black
c. Seed shape: triangular with concave and convex sides
d. Flower colour: pink/light pink
e. Crop duration: 80-100 days
f. Growth habit: predominantly indeterminate

I. Market:

Price in local market

(a) Seed Rs. 10-15/kg (b) Grian Rs. 8-10/kg

J. Growers' remarks:

a. Lack of marketing facility for buckwheat
b. Need high yielding, lodging resistant varieties
c. Unfamiliar with production technology. They broadcast seed and go to field only for harvesting. It is the case in all parts of the country.
d. Farmers are interested to grow more buckwheat if there would be assured market, high yielding cultivars and technology.
e. In this district buckwheat is used also for feeding milch animals.

K. Utilization:

In spite of other uses as in other parts of the hills, the buckwheat is used to feed milch animals also.

ANNEX. i

MID/FAR-WESTERN HILL REGION:

A. District: DAILEKH HQ: Dailekh Bazar

a. Population: 189561
b. Cultivated area:52310 ha
c. Area under buckwheat: 75 ha
d. Rainfall: 1790.8 mm/yr
e. Temp.: 13.8-23°C
f. Elevation:544-4168 masl

B. Sites visited:

Bilaspur, Ranimata, Dubli Gaira, Baraha, Basnta malla, Ghumkhuli

C. Expedition route:

Rampur = Nepalgunj = Surkhet - Ratanagla - Ranimata - Gurase - Dubli Gaira - Ghodabas - Talpokhari - Dhungeswor-Chupra - Dailekh Bazar - Ranibas

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Bilaspur	-	25	Sandy loam	No	Livestock
2	Ranimata	-	20	"	No	"
3	Dubli Gaira	-	21	"	No	"
4	Baraha	-	15	loam	No	"
5	Basantamalla	-	10	sandy loam	No	"
6	Ghumkhuli	-	5	loam	No	"
7	Ranibas	-	10	sandy soil (little FYM applied)	No	"

E. Total number of samples collected: eight

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat - fallow
b. maize/soyabean - buckwheat - fallow
c. potato - fallow - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland (rainfed system)
b. Productivity (kg/ha): 700 - 800
c. Production (ton/yr): 50 - 60
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small to large
b. Seed colour: dark brown/grey-black/light brown
c. Seed shape: triangular (rounded edges, winged as admixture)
d. Flower colour: light pink/pink/white
e. Crop duration: 80 - 100 days after sowing
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 20/kg (b) Grian Rs. 12/kg (at Surkhet Bazar)

J. Growers' remarks:

a. Need improved cultivars
b. Need improved production technology
c. Lack of market. They take their produce to Surkhet, where they either exchange with salt (1 kg buckwheat with 2 kg of salt) or sell it in attractive prices.
d. Farmers are interested to grow more buckwheat if there would be assured market for buckwheat in Dailekh or Surkhet.

K. Utilization:

In Dailekh also buckwheat is used as bread (thick), porridge (called Dhido), phulaura, sel (type of dunut), pan cake (called ryale roti), the leaves used as vegetable, straw is used to feed cattle, as bedding material and as supplement to fire wood.

ANNEX. i

A. District: JUMLA HQ: Jumla Bazar(Khalanga)

a. Population: 68797
b. Cultivated area: 14743 ha
c. Area under buckwheat: 50 ha
d. Rainfall: 563.3mm/yr
e. Temp.: 5.7-18.6°C
f. Elevation:915-4679 masl

B. Sites visited:

Raralihi, Kudari, Ranka, Harichaur

C. Expedition route:

Dailekh Bazar - Nauli - Padma Ghat - Chilkhee - Harichaur - Delikot - Khalna Ghat - Nagnaghat - Ranka - Jumla Bazar

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Raralihi	-	70	sandy loam	No	Livestock & cottage industry
2	Kudari	-	60	"	No	"
3	Ranka	-	7	clay loam	No	"
4	Kudari-1	-	55	loam	No	"

E. Total number of samples collected: four

F. Existing cropping patterns including buckwheat:

a. Buckwheat + wheat or barley
b. maize + potato - buckwheat
c. maize + broad bean - wheat - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland and low land
b. Productivity (kg/ha): 900 - 1000
c. Production (ton/yr): 45 - 50
d. Type of cultivat: local ecotypes

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: brown/dark brown/greyish black
c. Seed shape: triangular (with admixtures of different types)
d. Flower colour: pink/white/red
e. Crop duration: 80 - 100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 20/kg (b) Grian Rs. 12/kg

J. Growers' remarks:

a. Lack of assured market facility in Jumla itself.
b. Unfamiliar with modern production technology
c. Need improved varieties
d. Prefer buckwheat bread and porridge
e. Interested to grow more buckwheat if marketing facility would be there in Jumla itself.

K. Remarks/Utilization:

Jumla is one of the most remote districts of Nepal. It has no road networks (motorable) to join it with other districts. The trekking road also is very difficult. There is plane service to join it with Nepalgunj. The people are unaware of situations and development efforts/achievements in country and abroad. However, they showed willingness to grow more buckwheat if it will be payable to them. In this locality also buckwheat is used in same way as in other hilly regions of the Kingdom.

ANNEX. i

A. District: KALIKOT HQ: Manma

a. Population: 96399
b. Cultivated area: 23748 ha
c. Area under buckwheat: 60 ha
d. Rainfall: 730mm/yr
e. Temp.: 5.6-18.6°C
f. Elevation:1500-4790 masl

B. Sites visited:

Chilkha, Harichaur, Hawadi, Khada chakra, Tarimaman

C. Expedition route:

Dailekh Bazar - Hawadi - Khada Chakra - Tarimaman - Manma Bazar (1900 masl)

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Chilkha	1200	35	sandy loam	No	Livestock
2	Harichaur	-	25	loam	No	"
3	Hawadi	1500	22	sandy loam	No	"
4	Khadachakra	-	15	loam	No	"
5	Tarimaman	-	10	sandy loam	No	"

E. Total number of samples collected: five

F. Existing cropping patterns including buckwheat:

a. sarson (mustard) - buckwheat
b. potato - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland and low land (rainfed management)
b. Productivity (kg/ha): 800-900
c. Production (ton/yr): 50
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/brown
c. Seed shape: triangular (admixtures of different types)
d. Flower colour: pink/light pink
e. Crop duration: 100-120 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. (b) Grian Rs.

1 kg buckwheat is exchanged with 3 kg of salt.

J. Growers' remarks:

a. Lack of marketing facility
b. Lack of improved cultivars
c. Lack of transportation
d. Unfamiliar with production technology
e. Interested to grow more buckwheat if market will be there.

K. Remarks:

Kalikot is one of the most remote area in Nepal. The people here are deprived of development efforts. They exchange their produce with other goods. The buckwheat is exchanged with salt in 1:3 ratio by weight.

Buckwheat is the major staple food. It is used as porridge, and bread.

ANNEX. i

A. District: SALYAN HQ: Salyan Bazar

a. Population: 173959
b. Cultivated area: 45567
c. Area under buckwheat: 250 ha
d. Rainfall: 1109.6 mm/yr
e. Temp.: 14.8-23.3°C
f. Elevation: 457-3049 masl

B. Sites visited:

Payara, Marke, Bajghara, Tharmare

C. Expedition route:

Jimla = Nepalgunj = Dang = Salyan Khalanga - Marke - Payara - Bajghara - Tharmare

= by plane

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Payara	1550	15	sandy loam	No	Livestock
2	Marke	1600	10	"	No	Livestock & bamboo works
3	Bajghara	1500	8	silty	No	Livestock
4	Tharmare	1600	20	sandy loam	No	Livestock

E. Total number of samples collected: five

F. Existing cropping patterns including buckwheat:

a. potato - fallow - buckwheat
b. maize - buckwheat - wheat
c. maize+soyabean - buckwheat - fallow

G. Buckwheat cultivation:

a. Cultivation: uplands
b. Productivity (kg/ha): 700 - 800
c. Production (ton/yr): 175-200
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/brown/dark brown
c. Seed shape: triangular (rounded or winged edges)
d. Flower colour: pink/light pink/red
e. Crop duration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 12/kg (b) Grian Rs. 8/kg

J. Growers' remarks:

a. Lack of assured market for buckwheat
b. Need improved cultivars
c. Unfamiliar with improved production technology
d. Farmers practice exchanging buckwheat with salt (1:1 ratio by wt).
e. Farmers are interested to grow buckwheat if marketing facility for buckwheat will be created.

ANNEX. i

A. District: RUKUM HQ: Musikot

a. Population: 165634
b. Cultivated area: 29474 ha
c. Area under buckwheat: 80 ha
d. Rainfall: 1444.5 mm/yr
e. Temp.:14.8-23.3°C
f. Elevation:762-6072 masl

B. Sites visited:

Muru, Khara, Bahara than, Thara, Rungha, Khalanga, Tharedunga, Urma

C. Expedition route:

Tharmare (Salyan) - Rathikot - Childhale - Sewrath - Laurabang - Khaulachharna - Jhulneta - Larda - Bairagi Thati-Chapa - Serigao - Musikot

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Muru	800	20	sandy loam	No	Livestock
2	Khara	660	10	loam	No	"
3	Thara	900	8	clay loam	No	"
4	Rungha	800	7	sandy loam	No	"
5	Khalanga	1700	-	"	No	"
6	Tharedunga	1000	-	"	No	"
7	Urma	-	5	"	No	"

E. Total number of samples collected: eight

F. Existing cropping patterns including buckwheat:

a. maize - buckwheat
b. potato + colocasia - buckwheat
c. potato - buckwheat
d. fallow - buckwheat - fallow

G. Buckwheat cultivation:

a. Cultivation: upland (rainfed management)
b. Productivity (kg/ha): 700 - 800
c. Production (ton/yr): 60
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: black/brown
c. Seed shape: triangular
d. Flower colour: pink/red
e. Crop duration: 80-100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 20/kg (b) Grian Rs. 10/kg

J. Growers' remarks:

a. Lack of marketing facility
b. Need improved cultivars
c. Unfamiliar with improved production technology
d. Scarcity of seed during planting time
e. Farmers exchange buckwheat with salt.

K. Utilization/Remarks:

In Rukum buckwheat is used to make flour (bread), used as porridge, and also for feeding the cattle.

This district also comes among the remote hilly regions. The farmers/rural population use to exchange their goods. Buckwheat is most often exchanged with salt.

ANNEX. i

A. District: JAJARKOT HQ: Khalanga Bazar

a. Population: 99312
b. Cultivated area: 25751
c. Area under buckwheat: 135 ha
d. Rainfall: 1350 mm/yr
e. Temp.: 14-23°C
f. Elevation: 610-5412 masl

B. Sites visited:

Purma, Gangate, Chhiprena, Eber

C. Expedition route:

Musikot - Chaurjahari - Khalanga (Jajarkot) - Bhere - Chhiprena - Chaurjahari = Nepalgunj = Narayanghat = Rampur.

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Purma	1000	5	sandy loam	No	Livestock
2	Gangate	900	7	"	No	"
3	Chhiprena	1400	10	"	No	"
4	Eber	1500	8	"	No	"

E. Total number of samples collected: four

F. Existing cropping patterns including buckwheat:

a. potato - buckwheat
b. maize - buckwheat
c. maize+soyabean - buckwheat or barley
d. rice (upland) - buckwheat or wheat

G. Buckwheat cultivation:

a. Cultivation: upland
b. Productivity (kg/ha): 700 - 900
c. Production (ton/ha): 110 ton/yr
d. Type of cultivat: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/brown
c. Seed shape: triangular (with admixtures)
d. Flower colour: pink/red
e. Crop duration: 90 - 100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 20/kg (b) Grian Rs. 12/kg

J. Growers' remarks:

a. Lack of marketing facility
b. Unfamiliar with improved production technology
c. Need improved cultivars
d. Buckwheat is grown particularly for home consumption.
e. Farmers are interested to grow more buckwheat if there will be market for their produce.

ANNEX. i

A. District: ACHHAM HQ: Mangalsen

a. Population: 185212
b. Cultivated area: 15500 ha
c. Area buckwheat: 120 ha
d. Rainfall: NA
e. Temp.: NA
f. Elevation: 1220-3820 masl

B. Sites visited:

Thati, Marku, Safe

C. Expedition route:

Manma (Kalikot) - Thati - Safe - Marku

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrateded enterprises
1	Thati	-	-	loam	No	Livestock
2	Marku	-	-	"	No	"
3	Safe	-	-	"	No	"

E. Total number of samples collected: three

F. Existing cropping patterns including buckwheat:

a. potato - buckwheat
b. naked barley - buckwheat
c. wheat - buckwheat
d. cowpea - buckwheat

G. Buckwheat cultivation:

a. Cultivation: upland and low land (rainfed management)
b. Productivity (kg/ha): 500 - 700
c. Production (ton/yr): 60 - 80
d. Type of cultivate: local landraces

H. Morphological variations:

a. Seed size: small/medium
b. Seed colour: greyish black/dark brown
c. Seed shape: triangular
d. Flower colour: pink/light pink
e. Crop duration: 90 - 110 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 12/kg (b) Grian Rs. 6/kg

J. Growers' remarks:

a. Lack of assured marketing facility
b. Need improved high yielding varieties
c. Not familiar with improved production technology
d. They exchange buckwheat with salt in 1:1 ratio by weight
e. They use it to make bread, pudding, porridge.

ANNEX. i

A. District: BAJURA HQ: Tante

a. Polation: 74649
b. Cultivated area: 13500 ha
c. Area under buckwheat: 230 ha
d. Rainfall: 1343 mm/yr
e. Temp.: 5.7-18.6°C
f. Elevation:762-7036 masl

B. Sites visited:

Badu, Kolti, Ramkot, Martadi, Dhamkane

C. Expedition route:

Badu - Kolti - Dhamkane - Ramkot - Martadi

D. Description of location:

SN	Name of location	Altitude (masl)	Distance from HQ (km)	Soil type	Irrigation	Integrated enterprises
1	Kolti	-	-	sandy loam	No	Livestock
2	Ramkot	-	-	loam	No	"
3	Martadi-1	-	-	sandy loam	No	"
4	Dhamkane	-	-	clay loam	No	"

E. Total number of samples collected: four

F. Existing cropping patterns including buckwheat:

a. barley - buckwheat
b. mustard - buckwheat
c. wheat - buckwheat

G. Buckwheat cultivation:

a. Cultivation: up land and low land (rainfed management)
b. Productivity (kg/ha): 500-700
c. Production (ton/yr): 115-160.
d. Type of cultivate: local landraces

M. Morphological variations:

a. Seed size: small&medium
b. Seed colour: dark brown/brown
c. Seed shape: triangular(with admixtures)
d. Flower colour: pink/light pink
e. Crop duration: 100 days
f. Growth habit: indeterminate

I. Market:

Price in local market

(a) Seed Rs. 10/kg (b) Grian Rs. 8/kg

J. Growers' remarks:

a. Lack of marketing facility
b. Unfamiliar with improved crop production technology
c. Need improved cultivars
d. Interested to grow more buckwheat if market for it would be created.

K. Remarks/Utilization:

In Bajura, which is one of the most remote districts of Nepal, farmers are interested to grow more buckwheat if marketing facility will be there. They use it as vegetable, bread,pudding, porridge, sweets (sen), soup (gundruk), etc. It is the staple food in Bajura.

Annex - ii

STATEMENT OF EXPENDITURE

Reported to the Trimester Ending 1 Sept. 1990 - 14th July 1991.

Exploitation of Genetic Yield Potential of Common Buckwheat
(*Fagopyrum esculentum* Moench.) Ecotypes in Different Regions of Nepal

Budget activity	Total Project Budget, US$	Administered by USAID US$	Total Budget NFY 047/48 Rs.	Funds (Rs.) Received	Cumulative Expend (Rs.)	Balance Rs. NF
Mon./wages	42760	-	160800	145800	124823	
Materials/supp.	6137	-	8000	7671	7672	
Equipments	19500	19500	-	-	-	
Consultants	11600	-	-	-	-	
Training	5000	5000	-	-	-	
Travel	17750	-	203000	202824	268928	
Other costs	4253	-	10600	9100	3500	
Overhead	16050	-	167600	82950	92950	
Total	123050	24500	550000	448345	487828	

STATUS OF FUNDS

A.	Carryover balance	Rs. (39483)
B.	Cash received from USAID	Rs. 448345
C.	Total available	Rs.
D.	Gross expenditure as shown above	Rs. 487828
E.	Uncleared advances included in the gross expenditure	Rs
F.	Net expenditure after deducting E	Rs. 487828

This is to certify that the amounts stated above were expended for the activities authorized by PIL No. 1 of the PSTC and supporting documents are kept in accordance with Tribhuvan University rules and regulations.

Prepared by	Certified by	Forwarded by	Approved by
Accountant	Principal	Director	Chief Financial Controller
IAAS,TU	Investigator	DOR,IAAS	TU