
SMALL FARMERS PERCEPTIONS REGARDING IMPROVED FODDER AND FORAGE VARIETIES: RESULTS OF PARTICIPATORY ON FARM RESEARCH

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ABSTRACT:- Livestock is an integral component of rainfed farming system. Livestock rearing is also a substitute of crop farming and provide security against crop failure in uncertain weather conditions. Estimates reveal that livestock contribution into an average annual income of a farmer is about 40% of the total household income. Livestock feeding is a critical component of livestock management in the rainfed farming systems. The most binding constraints are: persistent nutritional stress, lack of improved fodder varieties and lack of fodder preservation techniques for lean period. To resolve this issue improved fodder varieties and forage species were introduced. About 52 % women were of the view that in *rabi* season 50% grain yield was increased and 44% said that the increase in dry stalk was about 50%. While in *kharif* 72% respondents pointed out 55% increase in grain yield and similarly majority of the farmers (68%) pointed out 50% increase in dry stalk yield. Majority of the respondents (83%) appreciated the newly introduced plant species while about 17% have shown their interest in fruit trees.

Key Words: Small Farmers; Fodder; Forage; Rainfed Areas; Rabi; Kharif; Pakistan.

INTRODUCTION

In rainfed farming system, animal husbandry plays a crucial role in rural economy and is closely linked with cropping system and dominated by small and the landless farmers. Livestock feeding is a critical component of livestock management in the rainfed farming system (Sheikh et al., 1988; Sial, 1991). Under rainfed conditions, fodder is not evenly available throughout the year. The crop residues and crops specifically grown for fodder purposes forms the bulk of the feed for both cattle and buffalo. The livestock holders access

to grazing land help in a relatively more economical way to meet the dietary needs of the animals (Bhatti, 1996). The supplementation of concentrates is another way to nourish the animals during fodder scarcity periods.

Due to increased demand, improved forage crops such as multicut oats, berseem, lucerne, sorghum-sudan grass hybrids, sorghum, maize and millet have been developed. These have become very popular in irrigated areas such as Faisalabad, Gujranwala, Kasur, Renala Khurd, Sheikhpura and Sargodha in Punjab province, Charsada, Mardan, Nowshera, and

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Peshawar in Khyber Pakhtoun Khaw province, and Halla, Hyderabad, Larkana, Nawabshah and Sukkur in Sindh province for sale to peri-urban dairies.

The natural vegetation is sparse and poorly available in the Pothwar area. Poor quality and scanty grass and scrub vegetation exist on steep eroded soils and mountain sides, but extensive grazing does not permit this vegetation to thrive (Rafique, 2000; Krischke, 1987; Pathak and Jakhmola, 1983). About 51% land is arable but only 40% is cultivated. Single cropped and double-cropped area constitutes 41% and 3%, respectively whereas 8% land area is under forests (Khan et al., 1999).

Small ruminant's production in the rainfed areas has tremendous potential for development and has comparative advantage with desired profitability margin. Some of the most binding constraints in this regard are: persistent nutritional stress, lack of improved fodder varieties and lack of fodder preservation techniques for lean period. Other important factors such as restriction of free grazing, reduced communal lands, decrease in the size of holdings and continuing land fragmentation are also limiting the small animals productivity (Khan et al., 1999; Sheikh et al., 1988 and Anwar et al., 2007).

Considering the role of women in livestock (Bahar, 1987; Rocheleau, 1991 and Lefebvre, 1990) and its nutritional aspects, International Center for Agricultural Research in the Dry Areas (ICARDA) had started a project entitled "Rehabilitation of Agricultural Livelihood of Women in Marginal and Post Conflict Areas of Afghanistan and Pakistan: Particip-

atory Research Dissemination and Adoption of Improved Goat Production Systems". Under project activities, fodder and forage intervention has been introduced to improve the nutritional aspects of dairy goats. The present exercise was specifically planned to assess the performance of fodder and forage intervention and also to explore the women's adoption behavior and their assessment about the future prospects of the given fodder and forage species. The generated information would provide feedback to the relevant stakeholders to streamline the future research and development endeavors.

The objectives of the study are to understand farmers' perceptions about the adoption of improved fodder and forage species; to examine the compatibility of given new fodder and forage varieties with the farm situations and rural livelihood strategies, and to quantify the farmer's perceived benefits from improved fodder and forage interventions.

MATERIALS AND METHOD

The purpose of technology assessment at different stages of development are to provide farmers views, priorities, decision criteria, resource availability, constraints and development opportunities (Anderson et al., 1985). The field trials managed on the participatory principals provide farmers views, their acceptance of the intervention and information on the compatibility of the intervention within the farming system and an opportunity to further refine (Anderson et al., 1985; Hildebrand and Poey, 1985 and Shah et al., 2004).

To see whether the given interventions properly targeted the intended beneficiaries or not, the implications of their diffusion are examined in a holistic manner. The holistic assessment of interventions are quiet difficult therefore, to cover each aspect of the interventions, both qualitative and quantitative information was collected and analyzed. The qualitative and quantitative analysis was mainly based on the descriptive statistics. To solicit women's perceived and observed benefits and costs of the technologies as well as their opinions on its potential adoption in different farm situations, a pre-tested questionnaire was used. Information was mainly collected from participating men and women. The information includes compatibility of technologies to the farm resource situations and their livelihood strategies established to improve the relevance of the technologies.

The fodder intervention was introduced in the 8 selected villages of the project. The total population of this experiment was 40 farmers, 5 from each village. More than 50%

participating women from 8 villages were selected as sample for this study. For forage intervention total sample of 95 was equally distributed among the villages. Around 11 or 12 respondents from each village were interviewed (Table 1).

The major intention of this effort was to highlight the farmers perceptions and performance of the given interventions therefore analysis was only restricted to descriptive statistics. For the descriptive analysis statistical package for social scientists (SPSS) was used.

RESULTS AND DISCUSSION

Rabi and Kharif Fodder Intervention

In *barani* Pothwar, *rabi* fodders are cultivated in winter and harvested in summer. Usually in rainfed areas, green fodder remains deficient in summer season. Fodder deficiency effects both animal and human population of the area. Some time prolonged bad weather conditions forced farmers to sell their animals. Hence to resolve this important issue cultivation of improved *rabi* fodder varieties like

Table 1. Distribution of sample size by villages for fodder intervention

Village	Percent
Mehar Ali	11.54
DhokPathan	11.54
DibaHarmal	7.69
DhokBali	11.54
ThattiBangla	15.38
Muthral	15.38
Murali	7.69
Mehmoodwala	19.23
Total	100.00

Table 2. Sample distribution by area allocation to *rabi* and *kharif* fodder trials

Rabi fodder	Percent farmers	
	<i>Rabi</i>	<i>Kharif</i>
Barley Sole	30.77	0.00
Barley + Vetch	7.69	0.00
Oat Sole	42.31	0.00
Oat + Vetch	19.24	0.00
Guar	0.00	100.00
Total	100.00	100.00

combination of oat vetch and barley vetch has been demonstrated. Majority of the farmers (42%) preferred to test oat sole and (30%) farmers have grown barley sole instead of combination of these varieties. Similarly, to increase the green fodder availability in winter lean period (December-February) improved variety of guar has been introduced. Almost all participating farmers have appreciated this intervention.

Sowing Conditions of Rabi and Kharif Trial

The improved fodder varieties have been tested under both rainfed and irrigated conditions. Data shows that 55.56% farmers planted fodder trials on their un-irrigated lands whereas 38% conducted *rabi* fodder trials on irrigated fields. Rest 6.44% farmers were more conscious and demonstrated performance of given interventions under both rainfed and irrigated conditions therefore they had tested these fodder varieties on irrigated and un-irrigated fields (Figure 1). While *kharif* trials (87%) were mainly conducted under rainfed conditions and a small proportion of farmers (13%) used

irrigated lands for guar fodder trials. Although the trials were mainly conducted to address the fodder availability issues in rainfed farming situation but for the sustainability of improved fodder varieties availability of seed is important. Therefore, some farmers were intentionally encouraged to allocate irrigated lands for guar trials.

Area under Fodder Interventions and Effect of Timely Planting on Yield

The induction of new crops in the existing farming system is difficult. Farmers only take risk if new crop is economically advantageous without disturbing its traditional cropping patterns (Figure 2).

Regarding the timing of the fodder trials, majority of the farmers pointed out that in both seasons trials were timely planted. While in *rabi* fodder trials a considerable proportion of the respondents (44%) have shown their concerns for late planting of trials. When farmers were asked about the effect of late planting on fodder crop, they highlighted various problems like less moisture, severe termite problem and even they were unable to harvest the trials

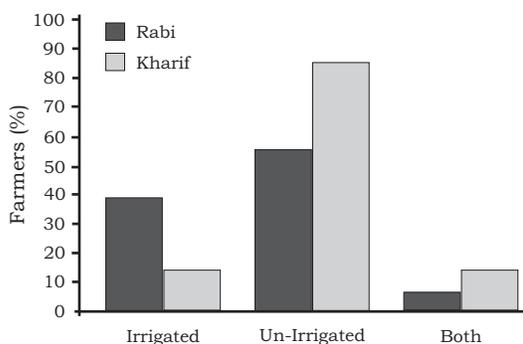


Figure 1. Irrigation wise status of fodder seeding trials

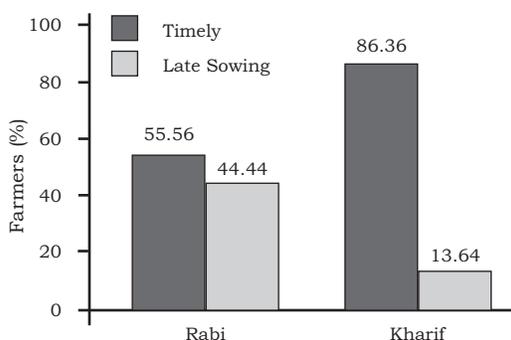


Figure 2. Trial time perceived by respondents

because crop was completely damaged. Moreover they have not seen the performance of these interventions. The non-availability of seed at an appropriate time was the main reason of late sowing in *rabi* season. So, on the basis of farmer's observation, it can be concluded that in the rainfed farming system, timely planting of crop is a critical component and had lot of implications in terms of productivity. Therefore in future development endeavors, time lines must be taken care of.

Grain and Dry Stalk Yield

In the rainfed farming system livestock and fodder has special significance. The productivity of traditional fodder crops is very low hence it is important to introduce high yielding fodder varieties (Hingra et al., 1995). In the adoption of any new variety, yield is important to show the performance of given intervention. Improvement in per acre yield agitates the participating and non-participating farmers to think about the adoption of new fodder varieties. In evaluating the technologies, rainfed farmers usually used grain and dry stalk yield as yard stick. The reason behind this phenomenon is that in rainfed areas farmers mostly cultivate dual purpose crops. Therefore improved barley and oat varieties for the *rabi* season and guar varieties have been introduced during the *kharif* season. The empirical results showed maximum 50% increase in both grain yield and dry stalk yield in *rabi* season (Table 3). While in *kharif* majority of the farmers (72%) pointed out maximum 55% increase in grain yield whereas,

Table 3. Farmers opinion about percent increase grain and dry stalk yield

		(%)
Farmers	Increase in grain yield in <i>rabi</i>	
10	10	
16	25	
12	30	
52	50	
Farmers	Increase in dry-stalk yield in <i>rabi</i>	
11	20	
34	25	
11	30	
44	50	
Farmers	Increase in grain yield in <i>kharif</i>	
10	15	
18	30	
72	55	
Farmers	Increase in dry-stalk yield in <i>kharif</i>	
11	25	
20	25	
68	50	

increase in dry stalk was about 50%. Overall, result indicated that the given interventions had potential to cultivate in the rainfed farming system of Pothwar Punjab.

Fodder Seed Produced by Farmer

The adoption trend and interest of farmers was analyzed by estimating the quantity of improved seed produced by participating house-holds. It showed that almost every participating household had produced own seed and also preserved for next year use. The quantum of seed produced was less because of their domestic requirements. Data reveals that in *rabi* season majority of the farmers

Table 4. Distribution of farmers by quantity of fodder seed produced

Fodder seed produced (kg)	Percent farmers	
	<i>Rabi</i>	<i>Kharif</i>
Upto 5	41.66	34.60
5.1 - 12	24.99	41.80
12.1 - 36	33.32	23.60
Total	100.00	100.00
Seed quantity kept for next year (kg)		
Upto 5	50.45	45.45
5.1 - 8	24.18	21.18
> 8.1	25.36	33.36
Total	100.00	100.00
Seed quantity sold (kg)		
2.00	35.00	25.00
6.00	45.00	60.00
9.00	20.00	15.00
Total	100.00	100.00

(41.66%) produced up to 5 kg seed (Table 4). While rest of the farmers produced 5-12 kg and 12.1- 36 kg improved fodder seed. The farmers who have produced higher quantity of seed have some irrigation facility and want to develop seed enterprise at local level. While in *kharif* fodder, 41.80% farmers produced the quantity of seed ranged between 5.1 and 12 kg. Overall it is evident from the research results that trend of fodder seed production is increasing gradually in the area. The present seed production level is encouraging parameter for adoption and sustainability of improved fodder varieties. Presently, farmers lacked in post harvest management and seed preservation techniques. In future research and development efforts, it is important to improve farmer's knowledge and skills of fodder seed production. The trend of

keeping improved fodder seed is evident from the data. Seed keeping was mainly based on the requirement of their animals. In *rabi*, majority of the farmers (about 50%) said that they keep upto 5 kg seed for the cultivation of next crop. Similarly, in *kharif* season, majority of the farmers preserved 5kg seed and some large farmers preserved upto 8 kg seed. Overall, this table reflected farmer's interest in the use of improved fodder varieties. The information regarding the seed quantities sold was also very encouraging (Table 4). It showed that both participating and non-participating farmers were happy with the performance of new fodder varieties. The data related to fodder seed sell-ing status also highlights expansion trend of new varieties in the area.

Farmers Perception about Fodder Intervention

The success of any demonstrated intervention completely depends upon the results of given technology. If an intervention produce positive results then the chances of its adoption remains high otherwise vice versa. The participating and non-participating farmer's response regarding the performance of fodder trials was collected. The data depicted that overall participating community has shown their satisfaction about the performance of the fodder trials (Table 5). A considerable proportion of the respondents show their dissatisfaction about the results. When reasons behind this dissatisfaction were explored, majority of them pointed out that their trials were disturbed due to late planting,

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Table 5. Sample and fallow farmers views about fodder trials

	(%)	
Opinion about trial results	<i>Rabi</i>	<i>Kharif</i>
Satisfactory	76.19	54.19
Unsatisfactory	23.81	45.81
Total	100.00	100.00
Fallow farmers interest		
High	86.36	66.36
Medium	4.55	10.74
Low	9.09	25.09
Total	100.00	100.00

insects and moisture problem. Moreover, fallow farmers interests was also explored. The results highlighted that fallow farmers had appreciated the performance of improved fodder varieties and ready to participate in the fodder related interventions. This is also reflected from the demand of fodder seed that has been given by the participating and non-participating households of the selected villages.

Farmers Intentions Regarding Continuation of Improved Fodder Varieties

The question whether farmer will continue improved fodder varieties or not was asked from the participating farmers. The analysis of empirical data indicates a positive trend regarding the continuity of introduced fodder varieties. Overall, fodder varieties of both seasons had shown significant increase in productivity but as compared to *kharif* interventions, varieties introduced in *rabi* season had good response from the farmers. The results indicated that a large majority (86.36%) of respondent had

Table 6. Respondent distribution regarding the continuation of trials and labors management

	(%)	
Would you continue trials	<i>Rabi</i>	<i>Kharif</i>
Yes	87.50	64.60
No	12.50	35.40
Total	100.00	100.00
Additional labor required		
Yes	26.67	18.27
No	73.33	81.73
Total	100.00	100.00
Type of labor required		
Female	66.67	58.67
Male	33.33	41.33
Total	100.00	100.00
How you manage extra labor		
By adjusting own time	88.46	78.46
Relatives	11.54	21.54
Total	100.00	100.00

shown their satisfaction and was convinced to adopt *rabi* fodder varieties. While regarding the *kharif* varieties, again 64.60% farmers had shown their satisfaction but at the same time a considerable proportion of the respondents (35.40%) had shown their concern and want to repeat fodder trials again for their complete satisfaction. Regarding the issue of additional labor, 73.33% respondents pointed out that there is no need of additional labor (Table 6).

Importance of Forages in Rainfed Farming System

In rainfed areas, forage has great importance because regular and adequate supply of nutritious forage is required to get maximum potential of available livestock species and to

fulfil the requirements of future livestock population (Chaudhry et al., 1985). In the rainfed areas of Pakistan shortage of green fodder is one of the critical factor associated with the livestock productivity (Sarwar et al., 2002). Livestock is an integral component of rainfed farming system and feeding of livestock is counted as a burning issue of this system. Traditionally, farmers used forages to meet the nutritional requirements of their animals. The common forage used in area was *Zizyphus*, *Acacia nilotica* and groundnut hay. During the survey, problems related to forage were identified in a consultative manner and on the basis of identified issues, various species of trees have been introduced. The subsequent part of this paper will depict the participating communities' responses regarding the performance of forage interventions.

Farmers Views about Tree Plantation

Information regarding the March tree plantation was obtained to see the interest of participating households in the tree plantation activity. The views of non-participating members of the respective communities have also been obtained. Majority of the respondents 58.33% perceived March transplantation as good and fine intervention. Similarly, 45.45% non-participating farmers had also shown positive attitude towards the species introduced to increase forage availability in the area. While explaining the benefits of plant species, some farmers 16.67% were of the view that large scale March tree plantation is not compatible

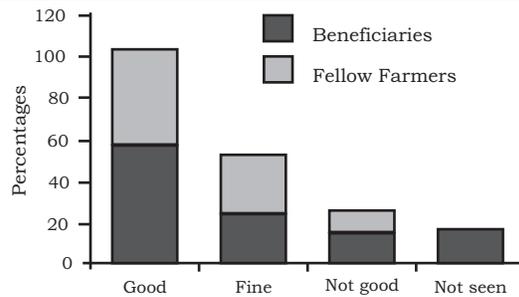


Figure 3. Farmers perceptions about March plantation

with climatic conditions of the area because March is a water scarcity month and tree plantation must be avoided (Figure 3). Overall, both participating and non-participating farmers perceived March tree plantation as best intervention for improving forage situation in the rainfed areas.

It is clear from the results that trees and shrubs had significance in the rural economy of Pothwar region. During the lean period, livestock especially small ruminants largely depends upon the trees leaves, shrubs and pasture lands. In drought situation, availability of green fodder, shrubs and grasses reduced and in that situation trees having enough biomass are used. The farmers having some off-farm income used supplementary feed resources. Due to poor nutrition conditions, animal health and productivity reduced which ultimately affected human health. Therefore to avoid both human and animal losses it is necessary to develop sustainable fodder and forage resources in the area.

Farmer’s Views and Suggestions about Plant Species

In an increasing trend of livestock population, the situation of

Table 7. Female's (beneficiaries) perception about type of trees planted in the target site

Category	Percent
Yes	83.33
No	16.67
Total	100.00
If no, than preferences	
Fruit Trees	100.00

fodder and forage was worsening day by day and an imbalance between the demand and supply of fodder was increasing. The improvement in the ability of range vegetation to support livestock and alternative feed resources need to be established in the area. Moreover, it is also important to reduce grazing pressure on the rangelands. Various plant species have therefore been introduced in the selected villages. The results reveal that majority of the respondents (83.33%) have shown their satisfaction about the usefulness of the given species while only about 16.67% had shown their dissatisfaction (Table 7). Basically they were interested in fruit plants because they give fruit, shade and forages for both human as well as to the animals. Therefore, it can be concluded that in the rainfed ecologies, plant species consisting fruit plants as well as plants having higher vegetative growth be introduced. It is important to maintain forage requirements and sustaining plantation activities.

Survival Status of Trees Planted

In tree plantation, survival of plants in a new environment has special significance therefore, information related to this aspect of

Table 8. March tree plantation survival rate

Categories	Percent Women
Initial survival rate	
Upto 0 %	8.33
Upto 20 %	8.33
Upto 25 %	20.33
Upto100 %	65.00
Total	100.00
Current survival rate	
Upto 0 %	8.33
Upto 25 %	16.16
Upto 50 %	8.33
Upto 65 %	16.16
Upto 100 %	50.00
Total	100.00

plants was collected from participating farmers. While collecting this information, participating farmers attitude, their likeliness, seriousness and management skills had also been explored. Overall, results shows that at the time of evaluation about 50% plants were reported surviving. Rest 50% plants were damaged or died due to initial shocks at the time of uprooting seedlings, poor management of supervisors and locations selected for these plants (Table 8). The present experience showed importance of tree plantation and also reflected that in such endeavors one must concentrate on the improvement of plant management skills of the farmers.

Suggestions for Improvement

The forage activity has great importance specifically in the context of goat production. Therefore, most of the participating and non-participating households have shown their interest in this activity. When these households

Table 9. Suggestion for improvement of tree plantation

Category	Percent
Strong institutional interaction	49.89
Maximum number of mulberry tree needed	33.33
More villagers should be included in the project	16.58
Total	100.00

were asked to suggest something for the betterment of tree plantation activity, majority of them (49.89%) stressed on the establishment of strong institutional linkages between experts and respective communities. Whereas, 33.33% farmers suggested promotion of mulberry tree in the next plantation activity. Both participating and non-participating respondents advised to promote it at larger scale in the area. The farmer's suggestions were quiet logical because in the rainfed ecologies mostly people don't have enough resources to manage their family and farm requirements (Table 9). The suggested mulberry trees had potential to fulfill both human and animal dietary needs. The help of related institutions is also extremely important to learn about the improved management techniques and seeking logistic support. So to sustain human and animal population in the harsh environment like Talagang, it will be beneficial if government initiate research and development projects for these specific ecologies.

Policy Recommendations

This study was conducted in the marginal areas of Punjab to see the performance of improved fodder and

forage varieties and problems associated with given interventions. Participatory mechanism was used to involve the local people. The participating farmers have small land holdings therefore area of trial was about 3 to 6 kanals. The project has provided only seed and technical guidance while all other activities have been performed by participating household themselves. Before starting the fodder activities conventional fodder varieties and system of production was explored. Traditionally grazing was main feeding source. In winter, animals grazed for only 4 hours, while in summer grazing activity was for 8 hours daily. Grazing activity is mainly performed by male family members. The summer temperature goes up to 50°C, while in winter temperature is 4 – 25 °C.

The project area is in low rainfall zone and usually received less than 500 mm rainfall annually. Fodder and forage availability is a serious problem in the area. In the lean period ber leaves (*Zizyphus*) are supplemented to goats. Groundnut is the main cash crop. Its residues are also used for small and large ruminants. Keeping in view the importance of livestock specially the small ruminants and their nutritional issues combination and sole fodders have been introduced in 10 villages. The results were quiet satisfactory and farmers have got almost double green fodder and dry stalk yield. The issue which they have pointed out was the availability of pure seed. The forage species have also performed well and majority of the farmers have appreciated the March tree plantation trials. The 100% initial survival rate was

reported by 65% farmers. Whereas, at the time of survey 50% farmers reported 100% survival of the plants. Some farmers have also recommended fruit trees for plantation.

Conclusion

- Participatory approach has proved well in the dissemination of skill and knowledge. Therefore in future development endeavors this approach needs to be used specifically in the traditional societies.
- Seed preservation skill is important and needs to be imparted to both male and female population of the area.
- Institutional linkages are important to maintain the supply of improved varieties and solutions of problems.
- Plants and nursery management skills lacked and needs immediate attention of the forest department.
- Instead of *Zizyphus* or other plant species mulberry trees needs to be promoted. It is equally useful for both animals and humans.

LITERATURE CITED

- Anderson, J. R. Dillon, J. L. and Hardaker, J. B. 1985. Socio-economic modeling of farming system, approaches to farming systems research, ACIAR FSR Workshop, 12-15 May, Hawkesbury Agriculture College, Richmond, NSW, Australia.
- Anwar, M.Z. Khan, A. Arshad, M. and Tariq, B. 2007. Socio-economic, livelihood, market and gender analysis, SSI-ICARDA collaborative research report (Unpublished).
- Bahar, S. 1987 Women in crop production and management decisions in *barani* Punjab: Implications for extension. Social Sciences Division, Pakistan Agricultural Research Council, Islamabad.
- Bhatti, M.B. 1996. Fodder production in rainfed areas of Punjab In: Proc. National Conf. on Improvement, Production, and Utilization of Fodder Crops in Pakistan, March 25-27.
- Chaudhry, M.H. Khan, M.A. and Saleem, M. 1985. Research on fodder crops in Punjab- A perspective. *Progr. Farming*, 5: 28-29.
- Hildebrand, P.E. and Poey, F. 1985. On farm agronomic trials in farming systems research and extension. Lynne Rinner Publishers, Inc. Boulder, Co.
- Hingra, S.H. Davis, B. and Akhtar, M.J.A. 1995. Fodder production. Food and Agriculture Organization of the United Nations, p. 88
- Khan, M.A. Sheikh, M.I. Khan, N.A. and Tariq, B. 1999. Baseline survey of livestock management in the rainfed farming systems of Pothwar and Shakargarh, Punjab. GTZ, GmbH. Socio-economic research studies. Social Sciences Institute, National Agricultural Research Centre Islamabad.
- Krischke, H. 1987. Potential of improved integrated forage production for small holder livestock farming systems in Pakistan. In: Proc. Workshop on Livestock in Farming Systems Research, Islamabad, April 8-15, p. 41-46.

- Lefebvre, A. 1990. Women, honor and money in Pakistani villages: An example of the strengthening of Traditions through Economic Development, *Denny Verden*, 23 (4): 84-89.
- Pathak, N.N. and Jakhmola, R.C. 1983. Forages and livestock production, Advent Books, New York. p.273.
- Rafique, S. M. (ed.) 2000. Proc. Fourth Meeting of the Temperate Asia Pasture and Fodder Network Pakistan Forest Institute June 6 - 11. Pakistan, Peshawar.
- Rocheleau, D. E. 1991. Genders, ecology, and the Science of Survival, Stories and lessons from Kenya. *Agriculture and Human Values* Winter/Spring.
- Shah, H. Mazid, A. Sharif M. and Majid, A. 2004. Characterization of rural livelihood and strengths in the barani areas of Pothwar. SSI-BVDP collaborative study. p. 142-148.
- Sheikh, A. Byerlee, D. Azeem, M. 1988. Analytics of Barani farming system of Northern Punjab: Cropping Intensity, Crop Livestock Interactions and Food Self-Sufficiency. p.1-2.
- Sial, M. A. 1991. Livestock production in Pakistan - Potentials and challenges. *Progr. Farming*, 11 (1): 7-14.
- Sarwar, M. Khan, M.A. and Iqbal, Z. 2002. Status paper, Feed Resources for livestock in Pakistan. *Int. J. Agric. Biol.* 4 (1): 186-192.
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