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SOCIO-ECONOMIC ASPECTS OF FODDER PRODUCTION IN URBAN AND PERI-URBAN AREAS OF FAISALABAD

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Fodder production and livestock farming are major farming activities in peri-urban areas of Faisalabad. A baseline survey was conducted to study socio-economic aspects and farming practices of the fodder growing areas in 2010-11. A total of 109 households, selected by snowball method, were interviewed based on a structured questionnaire. Results revealed that all households were headed by male and most of them (53%) had only completed primary education or even less. Agriculture was the predominant occupation as 89% of the households rely on it for income. Average income per household was US$ 550 per month with great variability. Berseem, maize and sorghum were identified as major commercial crops of the area grown by around 90% of the respondents. Most of the farmers (86%) rely on integrated fertilizer use (combination of mineral fertilizer and farm yard manure). Alternate canal and tube well watering was common as reported by 80% of the respondents. Major problems reported were the scarcity of irrigation water (97%), poor access to fertilizer (55%) and marketing of the farm products (45%). It is concluded that high illiteracy rate, shortage of irrigation water and an imbalanced use of fertilizers are the major reasons for low productivity. Introducing water and nutrient efficient crops and extension services for improved technology could provide good perspectives for a sustained fodder production in these peri-urban areas.
Keywords: Agricultural practices, baseline survey, livestock, nutrient efficient crops

INTRODUCTION

In 2011-12 total population of Pakistan was about 180 million with a growth rate of 2% where the share of urban and rural population was 37.53% and 62.47%, respectively. Pakistan is an agricultural country where the major part of the population lives in rural areas. Due to scarce employment possibilities, underdeveloped education and health infrastructure, migration from rural to urban areas continues and leads to ever higher demands for food, space and employment. Labour force of Pakistan was 57.24 million in 2010-11 out of which 3.4 million were unemployed (Mazhar, 2012). Poverty is thought to be synonymous with rural areas due to lower chances of employment opportunities but with population growth, the number of the urban poor seemed to increase as unemployment rate in urban areas is increasing (Farooq, 2013). Urban and peri-urban conditions in terms of poverty and food security can be worse without preventive measures. To fulfil the increasing demands of food and feed with reduced agricultural land due to increase in population and residential colonies is a big challenge. To meet this challenge growing of food crops in the residential areas was proposed to ensure the sustainable availability (Cofie *et al*., 2003). Urban and peri-urban farming constitute a source of indirect income, since some food does not have to be purchased from the market. The urban and peri-urban farming not only includes growing of food crops but also animal husbandry, agro-forestry and horticulture. It has become an extremely visible economic activity all over the world (Kwasi, 2010; Mkwambisi *et al*., 2011) due to short transportation ways, immediate availability of fresh food, less vulnerable to food price change and recycling of waste. The benefits are confronted with associated risks such as increased competition of land, water and labour.

Faisalabad is third largest city of Pakistan after Karachi and Lahore. Due to its textile industry, Faisalabad is also known as Manchester of Pakistan, but its agricultural basis in the Punjab where irrigated cropping of wheat, rice, cotton and fodder crops cultivated for livestock prevail, is equally strong. The district of Faisalabad comprises 5,856 km^2 with an estimated population of 2.6 million growing annually at 2%. At present 23.4% of the district's population resides in urban areas and this percentage is rapidly increasing due to better employment, education and health facilities in urban areas (Anonymous, 2009). Most people residing in peri-urban areas are livestock, fodder and vegetable farmers and their farming system ranges from self-consumption to commercial orientation. Due to the reduction of agricultural land in peri-urban areas, it is hard to fulfil the fodder requirements of the livestock farmers wherefore fodder has to be brought from other areas.

This study aims at addressing various aspects of urban and peri-urban agriculture (UPA) in Faisalabad to provide policy input for improving agricultural farming practices. It includes the information about income, education, farming types, agricultural practices and farming problems etc. To achieve this objective, a baseline survey was conducted comprising mainly fodder growing farmers, which is discussed in this paper.

MATERIALS AND METHODS

***Study area*:** Geographically Faisalabad is situated between 73° to 74° E and 30° to 31.5° N with an elevation of 604 feet above sea level and is located in the central Punjab province. Mean annual rainfall is about 550 mm with maximum and minimum temperature of 50°C and -1°C in summer and winter, respectively (Faisalabad, 2012). There are two main cropping seasons i.e. winter (Rabi) and summer (Kharif). Rabi (October-March) include different winter crops such as vegetables, Berseem, wheat and sugarcane and Kharif (April-September) include summer crops like vegetables, cotton, rice, fodder maize and sorghum (Table 1).

Table 1. Botanical names of different crops used in the text

Common name	Botanical name
Maize	*Zea mays*
Sorghum	*Sorghum bicolour*
Wheat	*Triticum aestivum*
Rice	*Oryza sativa*
Berseem	*Trifolium alexandrinum*
Sugarcane	*Saccharum officinarum*
Cotton	*Gossypium hirsutum*
Pearl millet	*Pennisetum glaucum*
Oat	*Avena sativa*
Sesame	*Sesamum indicum*
Cauliflower	*Brassica oleracea*
Spinach	*Spinacia oleracea*
Tomato	*Solanum lycopersicum*
Cucumber	*Cucumis sativus*
Radish	*Raphanus sativus*
Carrot	*Daucus carota*

The fodder producing zones from the adjoining areas of the city were selected for the study. There were two major fodder markets located in the West and South-west of the city. These markets were visited to determine the survey areas following a snowball sampling method (Berg, 1988; Sadler *et al*., 2010). Finally, 109 household were interviewed for their demographic and socio-economic characteristics, agricultural practices and production constraints in 2010-11 using a structured questionnaire. The geographical coordinates of all interviewed households were recorded with a Trimble GeoexplorerII (Sunnnyvale, CA, USA) for mapping purposes (Fig. 1).

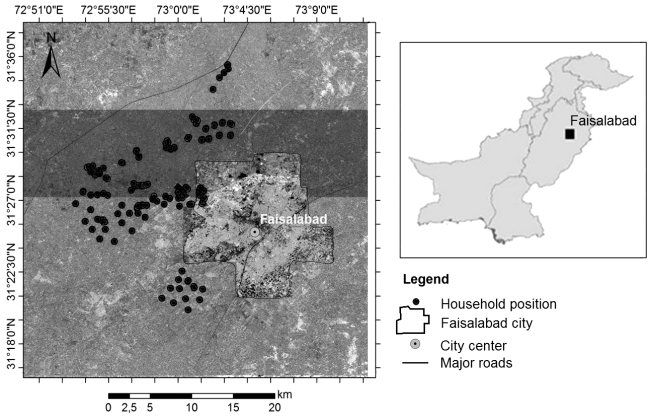

Figure 1. GIS-based map of Faisalabad (Pakistan) with the approximate expansion of the urban area (inside the polygon), major roads, city centre and position of interviewed households

***Statistical analysis*:** Descriptive analysis was carried out for the demographic characteristics, agricultural practices and problems while hierarchical cluster analysis was employed to identify different farming types using Ward's method and squared Euclidean distances. Discriminate analysis was carried between groups and to determine the importance of the variables used for clustering (Blashfield, 1976; Klecka, 1980). All analyses were done with SPSS statistical software (Statistics, 2008).

RESULTS

***Household characteristics*:** The results showed that males were the main earners of cash income and that most household heads (80.7%) were married and had agriculture as their main source of income. Most of the respondents were illiterate (26.6%), had only primary education (26.6%) and a few (10%) were graduates (Table 2). Average distance from the next agricultural market was 7.5 km and the major way of transport (92%) of agricultural products was the tractor trolley, some farmers also used animal driven carts for transport of goods.

The age of the respondents ranged from 20 to 80 with an average 46.2 years. Most of the households were characterized by a joint family system with 5.4 adults and 4.8 children. Annual income of a household of the studied area varied widely with an average of US$ 6,600. Only 11.9% of the households reported an annual income of more than $ 10,000 (Table 2).

***Farming types*:** Farmers had two types of land holdings; either they owned land (56%) or they rented land (13%), but mixed tenure systems also existed (31%). On the basis of

Table 2. Demographic characteristics of farmers in urban and peri-urban areas of Faisalabad, Pakistan during 2010 - 2011.

Household characteristics	Category	Frequency (n)	Percentage of total (%)
Marital status	Married	88	80.7
	Single	20	18.4
	Widowed	1	0.9
Occupation	Agriculture	88	80.7
	Others	21	19.3
Education	Illiterate	29	26.6
	Primary	29	26.6
	Metric	40	36.7
	Graduate	11	10.1
Type of land holding	Land owners	61	56.0
	Tenants	14	12.8
	Mixed ownership	34	31.2
Farm typology	Low LH*, Less LSH**	44	40.4
	Ordinary LH, Ordinary LSH	42	38.5
	Ordinary LH, large LSH	16	14.7
	Large LH, Ordinary LSH	7	06.4
Irrigation	Canal	17	15.6
	Tube well	2	1.8
	Canal + Tube well	80	73.4
	Waste water	10	9.2
Fertilizer type	MF$^{\Psi}$	8	7.3
	FYM$^{\Psi\Psi}$	1	0.9
	MF + FYM	94	86.2
	No fertilizer	06	5.5
Average number of family members	≤ 5	16	14.7
	6-10	53	48.6
	11-15	26	23.8
	> 15	14	12.9
Household estimated annual income (US$)	≤ 2500	20	18.3
	2501 – 5000	34	31.2
	5001 – 10,000	42	38.5
	> 10,000	13	11.9

* = Land Holding, $^{\Psi}$ = Mineral Fertilizer, ** = Livestock Heads, $^{\Psi\Psi}$ = Farm Yard Manure

total cultivated land and livestock numbers the cluster analysis divided households into four groups.

1. Small land holders with less number of livestock heads (less LH with small LSH). The first group comprised small farmers with 2.6±1.7 ha of land and 3.2±2.4 heads of livestock.
2. Ordinary size of land holding with ordinary number of livestock heads (ordinary LH with ordinary LSH). The second group included households with larger amounts of land (9.1±3.2 ha with 9.1±3.2 number of livestock heads.
3. Ordinary size of land holding with large number of livestock heads (ordinary LH with large number of LSH). The third group was consisted of farmers with ordinary land holding size (8.5±5.3) and large number of livestock heads (26.1±9.0).
4. Large land holders with large number of livestock heads (Large LH with large number of LSH). The fourth group had 39.2±12.0 ha with 12.9±5.8 livestock heads (Table 2).

Wheat, maize, sorghum and berseem were common crops in all groups. Except for the second group, all households were growing sugarcane.

***Livestock profile*:** Livestock was one of the most important sources of income in peri-urban farming systems and thus played a major role in the household economy. In the study area, 92.7% of the respondents had livestock, with buffalo being the pre-dominant animal (86.2% of the respondents) that was kept either alone or in conjunction with other livestock. Only few respondents (17.4%) had male adults those were kept for reproduction or beef purpose while female adults were kept for milk purpose. Cattle was the second most important livestock animal, kept by 46.8% of

the total respondents out of which only 36% had male adults kept for draught or reproduction. Other animals kept in conjunction with buffalo and cattle included goats, donkey, horses and sheep.

***Agriculture practices*:** Farmers grew different type of crops, whereby the crop choice depended on weather conditions and market value. All the farmers cultivated wheat as the major crop, whereas fodder crops like berseem, maize and sorghum were cultivated by 94.50, 90.80 and 83.5% of the respondents, respectively. Crops like sugarcane, rice, cotton and vegetables were grown by 49.5, 19.3, 14.7 and 18.3% of the respondents. Apart from these major crops some other crops like pearl millet, oat and sesame were also grown by some farmers for self-consumption (Fig. 2).

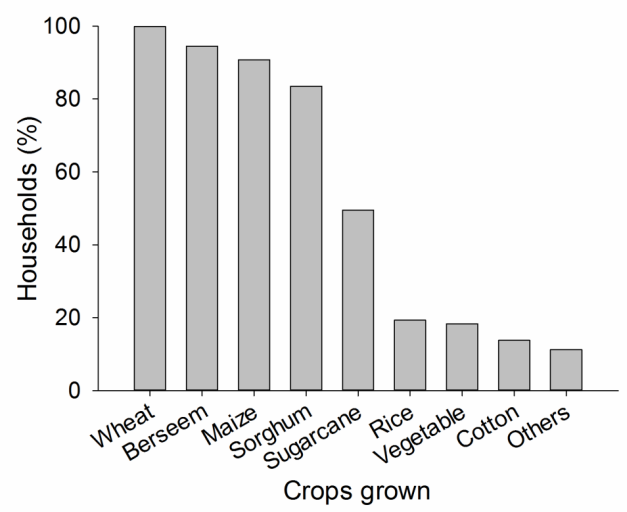

Figure 2. Major crops grown in urban and peri-urban areas of Faisalabad, Pakistan, during 2010-2011 (n=109).

Farm yard manure (FYM) was used as organic fertilizer while urea and di-ammonium phosphate (DAP) was used as mineral fertilizer sources. Integrated use of fertilizer (combination of FYM and mineral fertilizers) was common as practiced by 86% of the respondents (Table 2).

Mostly farmers grew wheat for self-consumption while surplus was sold. Average area per household under wheat cultivation was 2.5±3.1 ha. All respondents planted wheat by broadcasting and most farmers used herbicides, but none of the farmers used any insecticide or fungicide for this crop. Average yield was 3.9±0.5 t ha^{-1} and expenses US$ 179.0±46.6 per ha. Rice was second important food crop. It was also grown for domestic purpose and surplus was sold. The average area under rice cultivation was 1.1±1.8 ha. All rice was transplanted and treated with insecticides as needed. Average yield and cost of production per hectare was reported 2.8±0.8 t and US$ 206.1±75.3, respectively. Average area under berseem per respondent was found 1.06±1.6 ha. It was sown by broadcast method. Only few farmers (2.9%) applied insecticides to this crop at early stage. It had three to five cuts per season. Average green fodder yield was 82.2±13.8 t/ha. Average input expenses per hectare were $ 206.3±126.6. Most of the growers (77.7%) were supplying green fodder to the market. Average area per respondent under maize was 1.6±1.8 ha. It is sown by broadcast method in summer and spring seasons. Most of the farmers (75.8%) used insecticides for this crop at early stages of growth to control sucking insects. Per hectare average yield and input expenses for this crop were reported 37.2±8.6 t and $ 158.9±60.5, respectively. The majority of farmers (96.9%) sold it as fodder to the market. Average area under sorghum per respondent was 1.1±1 ha. Sowing method for this crop was broadcast method. Majority of the respondents (94.35%) growing sorghum, supplied it to the market. Average fodder yield and input expenses per hectare were 42.4±7.4 t and $ 118.5±59.8, respectively. The average area under sugarcane was 2.1±3.5 ha per respondent. Farmers grew it as a commercial crop by using cuttings from the previous crop. About 83% of the respondents who cultivated sugarcane used insecticides for crop protection. Average yield and input expenses per hectare were reported 80.3±19.7 t and $ 398.2±164.0, respectively. Average area under cotton crop was 0.88±0.71 ha per respondent and they planted it on ridges. All the respondents used insecticides for this crop as insects were the most important threat. Average yield and expense per hectare of this crop were reported 2.2±1.2 t and $ 307.8±98.9, respectively. High input expenses were due to intensive use of insecticides. Vegetables are also important crops in peri-urban area. Average area under vegetable was found 2.9±3.1 ha. Vegetables were sown on ridges. Cauliflower, spinach, tomato, cucumber, radish and carrot were major vegetables. Most of the respondents (91.3%) used pesticides for crop protection. Average yield and expenses of vegetables was 27.5±6.5 t and $ 347.7±83.9, respectively. Expenses for vegetable production were higher as more management and care needed for vegetable crops (Table 3).

Table 3. Area, yield and expenses of different crops grown in urban and peri-urban areas of Faisalabad, Pakistan during 2010 – 2011.

Crop	Area under cultivation (ha)	Expenses (US$ ha^{-1})	Yield per (t ha^{-1})
Wheat	2.50±3.1	179.0±046.6	3.9± 0.5
Rice	1.10±1.8	206.1±075.3	2.8± 0.8
Berseem	1.06±1.6	206.3±126.6	82.2±13.8
Maize	1.60±1.8	158.9±060.5	37.2±08.6
Sorghum	1.10±1.0	118.5±059.8	42.4±07.4
Sugarcane	2.10±3.5	398.2±164.0	80.3±19.7
Cotton	0.88±0.7	307.8±098.9	2.2±01.2
Vegetables	2.90±3.1	347.7±083.9	27.5±06.5

***Problems*:** Farmers in the study area encountered multiple challenges with water shortage being the main problem (reported by 94% respondents) that frequently resulted in crop losses (Fig. 3). In contrast, respondents using waste water irrigation had no problem with water shortage, but reported deficiencies in soil quality. Tube well water users, who were using such water due to shortage of canal water, reported high production costs. In some areas farmers even left their land barren due to lack of water. Fertilizer shortage was the second most important problem that was encountered in the study area. More than half of the respondents reported that the use of fertilizer affected crop production through increased market prices and an imposed shortage of fertilizer by distributers and middlemen. However, this problem was mostly mentioned by peasants who were not able to raise the capital to buy mineral fertilizer. Marketing was also one of the main problems and was reported by 46.5% of the respondents. This problem was mostly mentioned by farmers who cultivated sugarcane, fodder and vegetables, as there were no fixed prices of these commodities. High prices of pesticides and unavailability of high quality seed and high seed prices particularly of early varieties were reported by vegetable growers as additional challenges for food production. Pesticides were used intensively in cotton and some bogus non-registered pesticide companies supplied low quality products which jeopardized cotton growers' health.

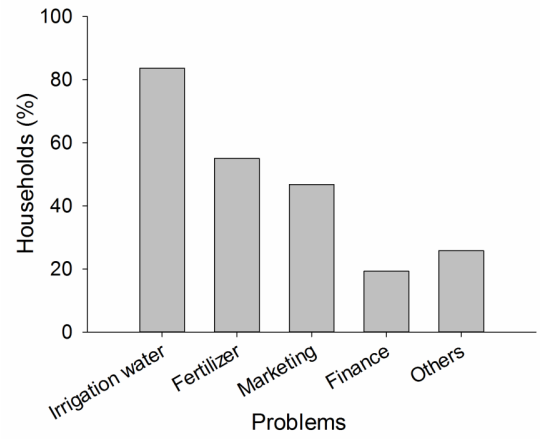

Figure 3. Major problems experienced by the farmers in urban and peri-urban areas of Faisalabad, Pakistan, during 2010 – 2011 (n=109).

DISCUSSION

In Pakistan it is common that the household responsibility rests with a senior male and only in case where there is no male household head or male members of the family are too young, household responsibility may rest with women (Fafchamps and Quisumbing, 1999; Naqvi *et al*., 2002; Hagmann, 2012). But there are some agricultural tasks such as hoeing of vegetables and transplanting of rice that are mostly done by women who contribute substantially to household income (Ali and Ahmad, 1984). Education plays an important role in the adoption of innovations such as balanced use of fertilizer and new machinery (Whartion, 1966; Asfaw and Admassie, 2004). More than 50% of respondents happened to be illiterate or had only primary school education. These results are supported by findings of Moaeen-ud-Din and Babar (2006) and Yasin *et al.* (2012) who worked on social aspects in peri-urban and city areas of Faisalabad and Multan and suggested improvements of health and education facilities as major avenues to improve household's livelihoods. Annual per capita income was found to be between US$ 1,000 and $ 2,500 for almost half of the respondents which correspond to a national per capita income of US$ 1372 (Ahmed, 2013).

Crop production and livestock farming appeared as major sources of income in rural and peri urban areas (Dorosh *et al*., 2003; Ali, 2007). In our study four major farming types were identified and all of them included crop and livestock farming. Most farmers growing fodder also kept animals so that at least they could produce dairy products for self-consumption. The majority of livestock holders had low land holdings, which is common in Pakistan, India and other agricultural countries (Iqbal *et al*., 1999; Devendra and Thomas, 2002; Holden and Yohannes, 2002; Köbrich *et al*., 2003; Ali, 2007).

For crop production almost all farmers used farm yard manure and mineral fertilizers, with nitrogenous fertilizer being dominant. Unbalanced use of nitrogen and phosphorus fertilizer has been reported in Pakistan (Pervaiz *et al*., 2004). Farmers used farmyard manure together with mineral fertilizer according to the resources they had, without any calibration, which may have been the main reason for yield differences among different farms. Almost all the farmers applied fertilizer by broadcasting. These findings are supported by other researchers (Ishaq *et al*., 2003; Jamil, 2004; Vitousek *et al*., 2009), who stated yield reduction due to low or imbalanced use of fertilizer. Coady (1995) reported very variable rates of fertilizer application according to the resources of farmers, ranging from zero to more than the recommended rates in developing countries. Herbicides and insecticides were most commonly used pesticides. All cotton, rice and sugarcane growers were using insecticides to protect their crops. Fodder crops were sprayed by insecticides only at early stages of growth because at later stages, when crops are fed to the animals, insecticides may harm them.

Maize, berseem and sorghum were the most important fodder crops. Most of the farmers grew fodder on a commercial basis, but some also grew it for their own livestock and the extra fodder was sold (Sarwar *et al*., 2002; Younas and Yaqoob, 2005). For small land holders fodder

production and milk sale was a main income source (Moaeen-ud-Din and Babar, 2006). Fodder was mainly grown by farmers with small land holdings, marginal lands or by farmers who could not afford the capital for high crop inputs. Byerlee and Husain (1993) and Kurosaki and Fafchamps (2002) worked at various sites distributed throughout Pakistan and reported crop-livestock interactions in marginal areas. Farmers marketed their extra fodder in different ways; they either sold standing fodder in the field or they supplied it to the fodder markets, where prices varied greatly according to the season. Prices were higher in the early season and were the lowest in the peak season due to changes in fodder supply. Similar trends in fodder markets were also reported by other researchers (Raja, 2001; Dost, 2003; Reynolds *et al*., 2005).

Pakistan is facing serious problems with irrigation water supply and this problem prevails also in urban and peri-urban areas of Faisalabad. Farmers reported that due to insufficient supply of canal water they had to rely on costly ground water (Masood *et al*., 2012; Trimmer, 1990). By using this ground water, costs of production increased significantly, while in some areas ground water was not appropriate for irrigation, so farmers had to rely on insufficient quantity of canal water, which resulted in low production. Trimmer (1990) suggested partial irrigation (supplying less water than crops need) to cope with this problem. Farmers who practiced waste water irrigation reported problems of soil deterioration and reduction in crop quality due to waste water associated chemicals and pathogens, which can cause enteric diseases to the consumers (Fattal *et al*., 1986; Mara *et al*., 2007). The long term use of waste water results in the accumulation of heavy metals and changes in microbial biomass (Friedel *et al*., 2000; Mapanda *et al*., 2005). Irrigation and drought problems also exist in tropical countries of Africa, such as in Kenya and Ethiopia (Abate *et al*., 1985; McWilliam, 1986; Holden and Shiferaw, 2005; Lal and Gupta, 2009). Adequate use of fertilizer is correlated with high yields, but major problems of the studied area, i.e. high costs and black marketing of fertilizer, resulted in low yields of small land holders who cannot afford it. Correspondingly, Masood *et al*. (2012) reported high fertilizer prices decreasing their use by poor farmers. Unavailability of good quality seed and pesticides may also have affected crop yield (Hussain *et al*., 2011; Salam, 2012). Hussain *et al*. (2011) reported a 35-50% reduction compared to potential yield due to the low quality seed, pesticides and fertilizer application.

***Conclusions*:** Fodder production and livestock farming are major sources of income in urban and peri-urban areas of Faisalabad. But due to high illiteracy and an insufficient knowledge about innovations, farmers were reluctant to adopt new technologies. The shortage of irrigation water, imbalance use of fertilizers unavailability of pure inputs like seed and pesticides and ignorance of farmer's problems by the government are responsible for low productivity of crops. To improve the overall situation of farm productivity, availability and affordable prices of quality of seed, pesticides and fertilizer may be ensured. Research is needed to identify water and nutrient efficient crops with acceptable forage quality to improve the productivity and income of urban and peri-urban farmers.

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