AERC STUDY No. 33

IMPACT OF DIESEL/POWER SUBSIDY WITHDRAWAL ON PRODUCTION COST OF IMPORTANT CROPS IN PUNJAB

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PREFACE

Punjab being a major paddy and wheat producing state has helped the country in achieving self-sufficiency in food grains production. The emergence of paddy and wheat monoculture has resulted in shifting area from traditionally cultivated crops towards these crops. But, this development has entailed increased use of chemical fertilisers, agro-chemicals etc. due to increased incidence of weeds, pest and diseases, and consequent use of higher amount of these inputs to raise the crop productivity. There is a sharp decline in underground water table in the state due to over exploitation of this vital natural resource especially for raising paddy crop. Punjab farmers are spending handsome amount to purchase diesel to run their tube wells during *kharif* season and Punjab Govt. purchase electricity at higher rates for free power supply to agricultural sector. Lately, the union government has been emphasizing to withdraw various subsidies in a phased manner. It is worthwhile to mention that withdrawal of diesel subsidy will hit hard the agricultural sector by significantly increasing the cost of cultivation/ production of various crops.

Keeping the above mentioned scenario into consideration, the present study is devoted to estimate the impact of diesel/power subsidy withdrawal on production cost of important crops in Punjab**.** Nevertheless, this attempt can be a basis for the policy planners for framing requisites policies in the interest of farming community especially in the event of such subsidies extraction.

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Authors

IMPACT OF DIESEL/POWER SUBSIDY WITHDRAWAL ON PRODUCTION COST OF IMPORTANT CROPS IN PUNJAB

Abstract

Punjab agriculture has been passing through a phase of severe ecological crisis exemplifying ever declining water table, excessive use of nitrogenous fertilizers, agro-chemicals, scarcity of labour and stagnant crop productivity. This, in spite of the fact that, Punjab agriculture has been subsidized to a large extent in the form of fertilizer, diesel and power subsidies. Lately, the union government has been contemplating to withdraw subsidies in a phased manner. The withdrawal of diesel subsidy will hit hard the agricultural sector by significantly increasing the cost of cultivation/ production of various crops. Oil Marketing Companies (OMCs) are increasing per litre diesel prices by Rs. 0.5 per month from January, 2013 and diesel subsidy is likely to be completely removed with automatic deregulation of fuel in next few months if the rupee continue to strengthen and monthly price hikes continue. Power supply to agricultural sector in Punjab is free and state government incurs huge subsidy bill every year. Keeping this in view, the present investigation entails to see the impact of diesel and power subsidy withdrawal and its likely impact on cost of cultivation/ production of important crops in Punjab agriculture. To meet the specific objectives of the study, six districts, two blocks, cluster of villages were selected randomly. In aggregate, sample of 300 farmer households with equal representation from all the farm categories were selected. Data on different components of cost-return structure of various crops were collected. Simple tabular analysis was conducted to analyse the results. Simulations with changing diesel prices were undertaken to work out the cost of production/ cultivation of various crops by keeping prices of all the other cost components at constant level from the time of data collection and just varying diesel prices only in order to see the impact of diesel subsidy withdrawal on cost of production of crops and also worked out 'diesel price hike coefficient'. Similarly, the impact of power subsidy withdrawal on cost of production of major crops in Punjab was also investigated by calculating the cost of the electricity consumed for irrigating various crops and adding it to the total variable cost. The results of the study brought out that the simulations regarding change in diesel prices, keeping prices of all other inputs at constant level (cetris-paribus), the cost of production of paddy increased by 7.06 per cent with the withdrawal of diesel subsidy while in case of basmati it was 5.18 per cent; 3.52 per cent in cotton, 2.63 per cent in sugarcane, 5.83 per cent in maize, 7.90 per cent in wheat and 8.81 per cent in sunflower. The changing diesel prices and its impact on cost of production of paddy, basmati, cotton, sugarcane, maize, wheat and sunflower was seen at I (base) level (1st February, 2013), secondly at II (current) level (1st June, 2014) and thirdly at III (proposed) level with zero diesel subsidy. In absolute terms, the cost of production of paddy was Rs. 494 per quintal at I level which increased to Rs. 517 per quintal at II level and to Rs. 528 at III level. In basmati crop, the cost of production was Rs. 890 per quintal at I level which increased to Rs. 921 at II level and further Rs.936 at III level. Similarly, the cost of production of cotton was Rs. 2859 per quintal at I level which increased to Rs. 2927 at II level due to increase in diesel price and Rs. 2959 at III level if there was complete withdrawal of diesel subsidy. Also, the cost of production of sugarcane was Rs. 125 per quintal at I level which increased to Rs. 127 at II level and further enhanced to Rs. 128 per quintal at III level. In maize crop, the cost of production was Rs. 714 per quintal at I level which increased to Rs. 742 at II level and further Rs.756 at III level. The cost of production of wheat was Rs. 572 per quintal at I level which increased to Rs. 603 at II level and further Rs.618 at III level with no diesel subsidy. In sunflower crop, the cost of production was Rs. 1631 per quintal at I level which increased to Rs. 1729 at II level and further Rs.1775 at III level. The diesel price hike coefficient showed that with one rupee increase in diesel price, the resultant cost of production of paddy increased by Rs.2.53; while increase was by Rs. 3.36 in basmati, Rs.7.31 in cotton, Rs. 0.24 in sugarcane, Rs. 3.03 in maize, Rs.3.29 in wheat and Rs. 10.45 in case of sunflower crop. The increase in cost of production of different crops under various farm categories due to withdrawal of diesel subsidy did not show any specific trend of increase or decline according to size of the farm category. The major impact of power subsidy withdrawal was seen on increase in cost of production of paddy (25.30%) due to more number of irrigations applied to this crop followed by basmati (21.24%), sunflower (9.07%), wheat (6.64%), maize (3.50%), sugarcane (3.28%) and cotton (1.75%). In absolute terms, the cost of production of paddy increased from Rs. 494 per quintal to Rs. 619 per quintal due to withdrawal of power subsidy while in basmati the increase was from Rs. 890 to Rs. 1079, in cotton Rs. 2859 to Rs. 2909, in sugarcane Rs. 125 to Rs. 126, in maize Rs. 714 to Rs 739, in wheat Rs. 572 to Rs. 610 and in sunflower from Rs. 1631 to Rs. 1779. The impact of power subsidy withdrawal was more on semi-medium, medium and large farm categories as compared to marginal and small farms. In relative terms, the cost of production of paddy increased by 25.30 per cent due to withdrawal of power subsidy while in basmati this increase was by 21.24 per cent followed by sunflower (9.07%), wheat (6.64%), maize (3.50%), sugarcane (3.28%) and cotton (1.75%). In aggregate, the cost of production of paddy increased by 32.35 per cent due to withdrawal of both diesel and power subsidy. Similarly,

the increase in cost of production of basmati was by 26.42 per cent followed by sunflower (17.88%), wheat (14.55%), maize (9.33%), sugarcane (5.97%) and cotton (5.26%). In absolute terms, the cost of production of paddy increased from Rs. 494 per quintal to Rs. 654 per quintal due to withdrawal of both diesel and power subsidy while in basmati the increase was from Rs. 890 to Rs. 1125, in cotton Rs. 2859 to Rs. 3009, in sugarcane Rs. 125 to Rs. 129, in maize Rs. 714 to Rs 781, in wheat Rs. 572 to Rs. 655 and in sunflower from Rs. 1631 to Rs. 1923.The farm category-wise analysis showed that the impact of power and diesel subsidy withdrawal was more on large and medium farmers as compared to marginal and small farmers. The major policy issues drawn was that Punjab government should emphasize the union government to increase the minimum support price of crops, in commensurate with the diesel price hike coefficient. In case, power subsidy is withdrawn by the state government, farmers especially marginal and small one's should be compensated according to the electricity usage bill generated for irrigating various crops on their farms. It was emphasized that for keeping marginal and small farmers in farming business, subsidies especially power subsidy should not be withdrawn, however, their form can be changed for the benefit of these farmers.

CHAPTER-I

INTRODUCTION

India is one of the largest consumer of energy especially the fuel products in the world. With high economic growth and rising incomes, the consumption of commercial energy in country has increased four times since 1980-81. While the industrial sector continues to be the biggest consumer of commercial energy, its share has declined from 54 per cent in 1980-81 to 47 per cent in 2008-09. On the other hand, the share of agriculture sector has increased from 2 per cent to 7 per cent during this period (Jha et al, 2012). Oil is the largest energy source in India with a share of about 30.5 per cent in primary energy consumption basket. With stagnant indigenous production of crude oil/fuel products the increased demand for oil has to meet through increase in imports of crude oil. For an emerging economy like India, this gap is increasing over the years. Consumption of petroleum products during 2012-13 was 157.1 million metric tonnes (MMT) which was 6.0 per cent higher as compared to the 148.1 MMT consumed during 2011-12. During 2012-13 the country imported 184.8 MMT of crude oil against 171.7 MMT during 2011-12. High speed diesel oil being the major source of energy, accounted for 43.98 per cent of the total consumption of all types of petroleum products in India during 2012-13. This was followed by Petrol, LPG and Naphtha accounting for 10.02 per cent, 9.93 per cent and 7.82 per cent respectively (Ministry of Petroleum & Natural Gas, 2013).

Energy has always been essential for agricultural production. Traditionally, the primary energy inputs for agriculture were sun, manure and the human/ animal muscle power. However, the modern agriculture supplemented with agro-processing being highly energy intensive; traditional sources of energy, power and inputs do not meet its requirements to achieve production and productivity levels, which assures food and nutrition security in the country like India (NAAS, 2008). Thus, use of commercial energies in agriculture becomes inevitable with electricity, fertilizer and diesel oil as the main sources of it. Over the period of two and half decade, the contribution of electricity and fossil energy in agricultural production has gone up to 86 per cent and of agricultural workers and draught animals has come down to 6 per cent and 8 per cent, respectively (Jha et al, 2012[a]). Commercial energy used in agriculture can be divided in two categories, viz. direct use of energy for pumping and mechanization (tractors, power tiller, pump sets etc.) and indirect use of energy in the form of fertilizers and pesticides (Grace Communication Foundation, 2012).

Most of the modern farm machinery runs on diesel (tractors, combine harvesters and diesel pump sets) and electricity (electric motors/submersible pumps, etc). In a span of two and a half decades i.e. from 1980-81 to 2006-07, the share of diesel has increased from 1.5 per cent to 20 per cent of total energy-use in Indian agriculture. Although on all-India basis, tractor penetration remains low, still better irrigated states like Punjab have a high tractor density of over 1 per 1,0 ha of net sown area. Besides their use for traction power in farming, tractors are also being used for drawing irrigation water and rural transportation. Pumps in Indian agriculture are being used prominently for irrigation purpose. The number of farmers using diesel powered pumps is high in villages with limited access to electricity. Further, due to electricity shortage especially during the peak periods, even the electric pump sets require power backup of diesel powered generators. Also, there is rise in use of farm tools that run on diesel. As per the all India study report, after transport agriculture sector is the second major consumer of diesel accounting for about 13 per cent of total diesel consumption in the country. Of this, tractors consume 7.4 per cent followed by pump-sets and agriculture implements accounting for 2.9 per cent and 2.7 per cent respectively (Ministry of Petroleum & Natural Gas, 2013).

Consequent upon the Green Revolution, Punjab agriculture became the most energy intensive with abundant use of modern inputs like irrigation, fertilizers, farm power and agro-chemicals. It has been transformed from subsistence farming which was entirely dependent on animals for draft power, to mechanized farming using mainly inanimate power sources like tractors, diesel engines, electric motors etc. (Sharma *et al.,* 2005). From being 0.22 lakh in 1970-71, the total numbers of tractors rose by almost 20 times to 4.34 lakh in 2010-11. As compared to only 18 tractors per 000' hectares of net sown area in country, Punjab had 104 tractors in 2010-11. Irrigation forms the backbone of agriculture in Punjab and tube wells is the prime source of assured irrigation throughout the state with exception of a few south-western districts facing problem of brackish underground water. The tube wells in the state run on electricity and diesel energy. From merely 0.97 lakh in 1970-71, the overall number of electric tube wells has risen by almost 12 times to 11.42 lakh in 2010-11. Maximum number of tube wells (3.77 lakh) were installed during the 2000s, the reason being free of cost supply of electricity to the agricultural sector since the late nineties. However, during peak periods, shortage of electric supply leads to use of diesel powered gen sets to run the electric tube wells. In contrast, over time, diesel engine - run tube wells have lost their popularity due to high operational costs involved in comparison to the electric ones. Though the diesel engine tube wells increased during the period from 1970s, their number reduced from 3.2 lakh in

1980-81 to 2.0 lakh in 1990-91 and to 1.70 lakh in 2010-11 (Anonymous, 2012). Besides, state agriculture employs variety of other farm equipments/machinery being run on diesel oil. With this level of mechanization, the energy particularly the diesel constitutes sizeable part of cost of agriculture production in the state.

Subsidizing consumers of petroleum products including diesel has been a common phenomenon in many developing and emerging economies. Fuel subsidies generally arise out of desire to shield consumers, especially poor households, from high and often volatile fuel costs for lighting, cooking, and transportation. However, fuel subsidies are both inefficient and inequitable (Anand et al, 2013). Such subsidies encourage over consumption of fuel, delay the adoption of energy-efficient technologies, and crowd out high-priority public spending on physical infrastructure, education, health and social protection. Most of the benefits of fuel subsidies also go to higher income groups who tend to consume more fuel (Arze et al, 2012). Recognition of these shortcomings has led to an active debate in India as to the merits of replacing these subsidies with better targeted safety net measures. Fuel subsidy reforms have been on Indian government's policy reform agenda over the last decade.

Diesel retail prices continue to be regulated by the government of India since early 1970s and hence contributed in a major way towards the building up of fuel subsidies over the years. Government of India has recently taken a number of reform measures in fuel subsidy system. In June 2010, petrol pricing was liberalized and the intention to liberalize diesel prices announced. In its 2012-13 budget speech, the government stated its intention to limit all central subsidies (including those on fuels) to less than 2 percent of GDP in 2012-13, and reducing them to less than 1.75 percent of GDP over the next three years. In January 2013, the government announced that Oil Marketing Companies (OMCs) would have greater flexibility in setting diesel prices and that bulk users of diesel would pay unsubsidized prices. However, the government has yet to set out a clear plan and timeline for reforming remaining fuel subsidies (IMF, 2013).

OMCs increased per litre diesel prices by Rs. 0.5 per month from January, 2013 onwards with some exceptions. Since then, the diesel prices had risen by a cumulative Rs 10.12 per litre in 16 instalments and the diesel subsidy is likely to be completely removed with automatic deregulation of fuel in next few months if the rupee continue to strengthen and monthly price hikes continue (Daily Post, 2014,). The elimination of diesel subsidies will also help addressing large existing distortions in relative petrol and diesel prices which has

resulted in a substantial substitution of diesel for petrol automobiles and further exacerbated the fiscal cost of diesel subsidies. However, the full liberalization of pricing has its own challenges that need to be anticipated. Full liberalization may transfer the volatility of international prices to domestic consumers with a short time lag and thus, may generate substantial public resistance and possibly undermine liberalization. It may be more of a concern for diesel as compared to petrol as all income groups are affected through increases in the prices of other goods and services.

The subsidy on diesel is financed by the government of India, while electric power subsidy to agriculture is financed by the State Governments. During the recent decade impact of electricity subsidy to agriculture on financial health of state economy has been the most debated issue in Punjab. Benefits of electric power subsidy tended to favour cultivation of water intensive crops particularly rice. The uncontrolled withdrawal of ground water for crop production supported by subsidised electricity in the farm sector leads to rapid decline in the water level in different parts of the country (Kumar, 2007). The growing dependency on groundwater threatened land productivity, water resource sustainability and power sector viability. Agricultural power supplied at flat rate or free and viewed as entitlement must increasingly be managed as a scarce input (World Bank, 2011). Raising power tariffs in the farm sector to achieve efficiency and sustainability of groundwater use is the need of hour from social, economical and environmental point of view (Singh et al, 2014). Many Indian states are considering re-introduction of electricity metering in the farm sector to manage groundwater demand. The logic behind this is that at higher power tariff, with induced marginal cost of electricity and water, farmers will improve water use efficiency and enhance the water productivity (Kumar et al, 2011).

However, any policy changes with respect to energy pricing may have serious implications on farm level profitability through significant increase in cost of cultivation. The cost of cultivation data of the Commission for Agricultural Costs and Prices (CACP) reveal that expenses on energy based inputs have registered a spectacular increase since the 1990s (Jha et al, 2012[b]). Therefore, there is a need to assess the likely impact of energy price policy changes on the Indian agriculture. Punjab agriculture, being on forefront in terms of diesel/electricity energy consumption may hit hard due to policy changes resulting into the increase of cost of agricultural production. Subsequently, it will squeeze the profit margins of the farmers necessitating the government to increase minimum support price for various crops. In this context, the present study has been taken to analyse the likely impact of

diesel/electricity energy price hike policy on cost-profitability relationship of major crops in Punjab.

Specific objectives:

1. To study the status of electricity and diesel use for various crop-production activities in the state.
2. To examine the impact of squeezing diesel subsidy/enhancing diesel price on the cost of agricultural production and profitability, and;
3. To estimate the likely impact of power subsidy withdrawal (Hypothetical) on the cost of cultivation/production and profitability of major crops in the state.

CHAPTER-II

SAMPLING DESIGN AND METHODOLOGY

To meet the specific objectives of the study, multi stage random sampling technique was followed. At first stage six districts (of total 22) representing various agro-climatic regions of state were taken (Hoshiarpur represents the sub-mountain undulating zone, Amritsar, Jalandhar and Ludhiana represent the largest central plain zone and Bathinda and Fazilika represent South-western plain zone).. At second stage, from each of the selected district two development blocks were selected randomly. Thereafter, from each selected block a cluster of 2-3 villages was chosen randomly for the farm household survey. Finally from each of the selected village cluster, 25 cultivators comprising 5 cultivators representing each of different categories as per standard national level definition of operational holdings viz., marginal (< 1 ha), small (1- 2 ha), semi-medium (2- 4 ha), medium (4 - 10 ha) and large (> 10 ha) were taken randomly. Thus, overall from the state, total sample of 300 farmer households comprising 60 farmers each of marginal, small, semi-medium, medium and large categories forms the basis for the present enquiry. The detail of sampled districts, blocks and villages is provided in Table 1.The important crops of the state like wheat, paddy, cotton, maize, sugarcane and major oilseeds/pulses were selected for the detailed analysis. In order to accomplish the objectives of the study, the required information pertaining to the year 2012-13 has been collected from the sample farm households by personal interview method using well structured pre-tested schedules.

2.1 Data Analysis

To work out composition of the structure of cost of cultivation of selected crops and contribution of diesel energy in the same, the tabular analysis was employed. For this purpose all the components of variable cost in value terms as well as physical terms (wherever possible) were considered. These included labour cost (own and hired), owned and hired machine power (tractors, combine harvesters, electric/submersible and diesel pumps, etc) charges with special emphasis on hourly use and input involved (particularly diesel), seed manure, fertilizers, insecticides, weedicides, irrigation, interest on working capital and other miscellaneous costs.

The gross returns from each crop enterprise have been worked out by multiplying the physical output, both main as well as by-product with the respective average prices. Simple

statistical tools such as averages and percentages were used for the interpretation of the results.

To assess the likely impact of recent diesel price policy changes on the Punjab agriculture, different synthetic situations were generated through considering partial and fully unregulated diesel prices along with other assumptions (like exchange rate of rupee). These synthetic situations were used to quantify the impact of recent diesel oil policy on the cost of cultivation of selected crops and subsequent squeeze of the profit margins of the farmers in Punjab. Impact of de-subsidised electricity supply to agriculture sector on cost of production of important crops in Punjab was also worked out. For this purpose per hectare electricity consumption for irrigation of a crop on sample farms was worked out as following:

Electricity use in irrigation (Kwh/ha) = Use of electric pump (electric motor or submersible) for irrigation of crop (hours/ha) x HP of electric pump

x 0.746 kwh + 20 % inefficiency

Cost of electricity consumption for each crop was estimated through multiplying the per hectare electricity consumption with the subsidy amount of Rs 4.18/kwh, which was approved by the Punjab State Electricity Regulatory Commission for electricity supplied to the farm sector in Punjab during year 2012-13 (PSERC-Tariff Order for FY 2013-14).

Table 2.1.1: List of selected districts, blocks and villages in Punjab, 2012-13.

Agro-climatic Zone	District	Name of Blocks		Number of Sample Farmers				
			Marginal	Small	Semi-medium	Medium	Large	Total
Sub-mountain Undulating	Hoshiarpur	Bhunga	5	5	5	5	5	25
		Mahlpur	5	5	5	5	5	25
Central Plain	Amritsar	Chogawan	5	5	5	5	5	25
		Tarsika	5	5	5	5	5	25
	Jalandhar	Nakodar	5	5	5	5	5	25
		Bhogpur	5	5	5	5	5	25
	Ludhiana	Khanna	5	5	5	5	5	25
		Sidhwan Bet	5	5	5	5	5	25
South-Western Plain	Bathinda	Talwandi Sabo	5	5	5	5	5	25
		Sangat	5	5	5	5	5	25
	Fazilika	Fazilika	5	5	5	5	5	25
		Khuian sarwar	5	5	5	5	5	25
Total sample size	6	12	60	60	60	60	60	300

CHAPTER-III

RESULTS AND DISCUSSION

The results have been discussed under various sub-heads:

3.1 Socio-economic characteristics of the respondents

3.2 Cost - return structure of major crops

3.3 Sources and frequency of diesel purchase

3.4 Diesel and power subsidy withdrawal impact

3.5 Conclusions and policy implications

3.1 Socio-economic characteristics of the respondents

It is very important to look into the socio-economic characteristics of the sample respondents to investigate about their adoption level of agricultural technology to peep into the level of resource use especially diesel consumption.

3.1.1 Household composition

The household composition of the respondent farmers has been shown in Table 3.1.1. In an overall scenario it was seen that there were about 40 per cent adult males in the families of respondent farmers followed by about 35 per cent adult females and 25 per cent minors. This shows the skewed sex ratio among the respondent farmer families. The farm category-wise

Table 3.1.1: Household composition of respondent farmers, Punjab, 2012-13

(Number/farm)

Family composition	Marginal	Small	Semi-medium	Medium	Large	Overall
Adult male	2.17 (44.22)	2.28 (41.39)	2.23 (41.74)	2.62 (36.01)	3.07 (37.55)	2.47 (39.64)
Adult female	1.77 (36.05)	2.00 (36.25)	1.88 (35.20)	2.45 (33.72)	2.92 (35.71)	2.20 (35.31)
Minor	0.97 (19.73)	1.23 (22.36)	1.23 (23.06)	2.20 (30.27)	2.18 (26.74)	1.56 (25.05)
Total	4.90 (100.00)	5.52 (100.00)	5.35 (100.00)	7.27 (100.00)	8.17 (100.00)	6.24 (100.00)

Figures in parentheses are percentages of the total

analysis revealed that relative proportion of adult males as compared to adult females was more among marginal, small and semi-medium categories as compared to medium and large farm categories. But in absolute terms the number of household members was highest on large farms (8.17) as compared to lowest (4.90) on marginal farms. Thus, due to higher size of holding on large farms there was more number of people dependent on it.

3.1.2 Age of family head

The age of the family head is also an important indicator of the type of farm activities undertaken on the farm. The age of the family head has been given in Table 3.1.2. A perusal of the table reveals that in overall, about 38 per cent of the family heads were more than 50 years old while about 35 per cent were aged between 36-50 years and remaining 27 per cent were quite young and aged up to 35 years. The category-wise analysis also reveals that the relative proportion of number of family heads with more than 50 years age was more among all the farm categories which shows that involvement of older people was more in the decision making process on the sample farms.

Table 3.1.2: Age of the family head on sample farms, Punjab, 2012-13

(Numbers)

Age groups	Marginal	Small	Semi-medium	Medium	Large	Overall
Up to 35 years	16 (26.67)	18 (30.00)	19 (31.67)	15 (25.00)	13 (21.67)	81 (27.00)
36-50 years	20 (33.33)	17 (28.33)	22 (36.66)	21 (35.00)	24 (40.00)	104 (34.67)
>50 years	24 (40.00)	25 (41.67)	19 (31.67)	24 (40.00)	23 (38.33)	115 (38.33)
Total	60 (100.00)	60 (100.00)	60 (100.00)	60 (100.00)	60 (100.00)	300 (100.00)

Figures in parentheses are percentages of the total.

3.1.3 Educational status

The educational status of the head of the family has been shown in Table 3.1.3. A perusal of the table reveals that in overall, the relative proportion of the respondents with education up to matriculate was higher (48.00%) followed by education up to secondary (15.66%), primary (9.67%), graduation (9.67%) and post- graduation (2.00%) level. The farm category-wise analysis also reveals that majority of the respondents were educated up to matriculate level with higher relative proportion on marginal (58.33%) farms as compared to lowest (38.33%)

on large farm category. Also, the proportion of respondents with education up to graduation level was higher (18.34%) on large farms as compared to other farm categories.

Table 3.1.3: Educational status of head of the family on sample farms, Punjab, 2012-13

(Numbers)

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Illiterate	12 (20.00)	9 (15.00)	8 (13.38)	9 (15.00)	7 (11.67)	45 (15.00)
Primary	4 (6.67)	7 (11.67)	5 (8.33)	8 (13.33)	5 (8.33)	29 (9.67)
Matriculate	35 (58.33)	28 (46.66)	30 (50.00)	28 (46.67)	23 (38.33)	144 (48.00)
Secondary	8 (13.33)	6 (10.00)	7 (11.66)	12 (20.00)	14 (23.33)	47 (15.66)
Graduate	0 (0.00)	7 (11.67)	8 (13.33)	3 (5.00)	11 (18.34)	29 (9.67)
Post Graduate	1 (1.67)	3 (5.00)	2 (3.33)	0 (0.00)	0 (0.00)	6 (2.00)
Total	60 (100.00)	60 (100.00)	60 (100.00)	60 (100.00)	60 (100.00)	300 (100.00)

Figures in parentheses are percentages of the total

3.1.4 Land holding details

The land holding details of the sample farms have been given in Table 3.1.4. A perusal of the table reveals that the total operational holding per farm was 5.62 hectares with land owned being 3.61 hectares; land leased-in 2.13 hectares and land leased-out 0.12 hectares. The relative proportion of the land leased-in was more than land leased-out on the sample farms. The entire area under cultivation was irrigated with average rental value of land leased-in being Rs. 68,180 and that of land leased-out being Rs. 71,430 per hectare. The average per hectare rental value of land leased-in was highest (Rs.72, 148) on large farms and lowest (Rs.60,000) on marginal farms.

Table 3.1.4: Land holding details of the sample farms, Punjab, 2012-13

(Ha/farm)

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Land owned (a)	0.98	1.49	2.62	4.68	8.30	3.61
Land leased-in (b)	0.06	0.22	0.67	2.23	7.46	2.13
Land leased-out (c)	0.30	0.00	0.03	0.28	0.00	0.12
Total operational holding (a+b-c)	0.74	1.71	3.26	6.62	15.77	5.62
Irrigation intensity (%)	100.00	100.00	100.00	100.00	100.00	100.00
Average rental value of land leased-in (Rs/ Ha)	60000	64845	63370	69285	72148	68180
Average rental value of land leased-out (Rs/ Ha)	74375	0	55000	73750	0	71430

Figures in parentheses are percentages of the total

3.1.5 Source(s) of irrigation

Irrigation is an important component of successful farming. The respondent farmers were enquired about the availability of various sources of irrigation on their farms (Table 3.1.5). It is quite obvious from the table that electric motor, submersible pump, diesel engine, generator and canals were the various sources of irrigation on the sample farms. These sources were used alternatively, collectively and as and when required on the sample farms. The numbers of submersible pumps per farm were highest (0.76) in an overall scenario followed by generator (0.27) electric motor (0.23) and diesel engine (0.17). The area coverage by combined use of electric motor, submersible pump, diesel engine and generator in various permutations and combinations was higher as compared to using these irrigation sources individually. However, generator use was higher on large and medium farms as compared to other farm categories due to higher number of generators owned on these farms.

Table 3.1.5: Various sources of irrigation on the sample farms, Punjab, 2012-13

(Hectare/farm)

Source (s)of irrigation	Marginal		Small		Semi-medium		Medium		Large		Overall	
	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Electric motor	0.10	0.92	0.20	1.70	0.10	3.32	0.22	6.62	0.52	17.29	0.23	6.42
Submersible pump	0.17	0.71	0.50	1.71	0.82	3.32	1.07	6.71	1.27	15.45	0.76	6.26
Diesel engine	0.15	0.83	0.18	1.75	0.15	3.01	0.17	6.84	0.22	16.95	0.17	5.46
Generator	0.08	0.90	0.12	1.86	0.22	3.45	0.40	6.80	0.53	17.21	0.27	9.58
Electric motor + Submersible pump	-	-	-	-	-	-	0.02	9.00	0.02	12.80	0.01	10.90
Electric motor + generator	0.02	0.80	0.02	1.20	0.02	3.40	-		0.05	14.67	0.02	8.23
Electric motor+diesel engine+canal	-	-	-	-	0.03	3.20	0.02	7.20	-	-	0.01	4.53
Electric motor+diesel engine	-	-	-	-	0.05	2.90	0.05	6.93	0.03	17.00	0.03	7.94
Electric motor+diesel engine+generator	-	-	-	-	-	-	-	-	0.03	17.00	0.01	17.00
Electric motor+generator+canal	-	-	-	-	-	-	-	-	0.02	40.00	0.02	40.00
Bore well	0.05	0.67	0.02	2.00	-	-	0.02	6.00	-	-	0.02	2.00
Borewell + Diesel engine	0.07	0.90	0.02	1.60	0.03	2.60	0.08	7.36	0.03	14.00	0.05	5.37
Electric motor + canal	0.02	1.00	-		-		0.05	7.20	-	-	0.01	5.65
Electric motor + diesel engine+canal	-	-	0.03	1.80	-	-	-	-	-	-	0.01	1.80
Bore/EM/Canal	0.07	1.00	-	-	-	-	-	-	-	-	0.01	1.00
Submersible+generator+canal	0.02	1.00	-		0.08	3.16	0.10	6.20	0.07	12.40	0.05	6.48
Submersible+generator	0.03	1.00	0.07	1.70	0.20	3.45	0.30	6.58	0.50	16.12	0.22	9.88
Submersible+canal	0.13	0.59	0.22	1.78	-	-	-	-	-	-	0.07	1.33
Submersible+diesel engine+canal	-	-	-	-	-	-	0.02	13.00	-	-	0.02	13.00

3.1.6 Income from farming

The income from farming and other sources have been depicted in Table 3.1.6. A perusal of the table reveals that in overall Rs.8,01,364 was the total income of the sample farms from farming, dairy farming, service, business and other sources. The relative share of farming in the total income was 99.20 per cent followed by dairy farming (0.43%), service sector (0.15%), business (0.14%) and other sources (0.08%). The category-wise analysis reveals that the relative share of farming in total income was lowest (74.19%) on marginal farms and highest on the large farms (99.80%). On the contrary, the relative share of dairy farming, service sector, business and other sources in total income was highest (75.81%) on marginal farms as compared to other farm categories. Therefore, farming was the major component of income on the sample farms followed by other sources.

Table 3.1.6: Income (Annual) from farming and other sources on sample farms, Punjab, 2012-13

(**Rs. / farm)**

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Farming	80702 (74.19)	213962 (93.65)	426062 (98.28)	929966 (99.42)	2357674 (99.80)	794923 (99.20)
Dairy farming	11777 (10.83)	6853 (3.00)	4752 (1.10)	2484 (0.27)	2887 (0.12)	3485 (0.43)
Service sector	7522 (6.91)	4876 (2.13)	516 (0.12)	2094 (0.22)	320 (0.09)	1229 (0.15)
Business	2136 (1.96)	2384 (1.04)	614 (0.14)	805 (0.09)	1108 (0.05)	1084 (0.14)
Other sources	6643 (6.11)	389 (0.17)	1564 (0.36)	0 (0.00)	467 (0.02)	643 (0.08)
Total	108780 (100.00)	228464 (100.00)	433508 (100.00)	935349 (100.00)	2362456 (100.00)	801364 (100.00)

Figures in parentheses are percentages of the total

3.1.7 Ownership of farm machinery/ implements

The ownership of farm machinery/ implements on the sample farms has been given in Table 3.1.7. A perusal of the table reveals that in overall, average number of tractors per farm was 0.79 with 43.94 H.P. and present value being Rs.1,94,106. The category wise analysis reveals that the number of tractors per farm was 1.38 on large, 1.07 on medium, 0.90 on semi-medium, 0.45 on small and 0.13 on marginal farms. Thus, all the respondents on medium and large farms owned at least one tractor while very few respondents on marginal, about fifty per cent on small and almost every respondent, except a few, on semi-medium farm category owned a tractor. The average number of tractor drawn implements was 5.70 on large, 4.20 on medium, 3.70 on semi-medium, 1.32 on small, 0.18 on marginal and 2.89 in an overall scenario. Therefore, the present value of tractor drawn implements was more on large farms due to their higher number as compared to other farm categories.

3.1.8 Cropping pattern and cropping intensity on the farms

Cropping pattern and cropping intensity on the sample farms have been shown in Table 3.1.8 and 3.1.9. A perusal of the table 1.8 reveals that during *kharif season* paddy was the major crop occupying 2.32 hectares (18.83% of gross cropped area) of the operational holding in overall scenario followed by 1.09 hectares (8.85%) under Bt cotton, 0.77 hectares (6.26%) under Basmati and rest 1.44 hectares under other *kharif season* crops such as; sugarcane (3.44%), maize (1.90%), guara (0.94%), fodder (3.23%), vegetables (0.41%) and green manuring crops (1.69%) of the gross cropped area. The farm category wise analysis revealed that paddy was major crop sown on all the farm categories followed by Bt cotton, basmati and maize crops. During *rabi season* wheat was the major crop sown on 4.58 hectares (37.20 % of the gross cropped area) in overall scenario followed by fodder (0.35 ha), potato (0.17 ha) and other minor crops. The crops sown during *zaid season* in overall scenario were; potato (0.40 ha), sunflower (0.26 ha), spring maize (0.12 ha), vegetables (0.19 ha) and mentha (0.08 ha). The percentage share of *zaid season* crops was 8.51 per cent of the gross cropped area on the sample farms. Fodder (0.03 ha) was the only crop sown in the *summer season* to cater to the needs of the cattle. The cropping intensity was 219.24 per cent in an overall scenario with highest on large farms (222.81%) and lowest on marginal (206.84%) farms.

Table 3.1.7: Ownership of farm machinery/ implements on the sample farms, Punjab, 2012-13

(Per Farm)

Particulars	Marginal		Small		Semi-medium		Medium		Large		Overall	
	No.	Present value (Rs)	No.	Present value	No.	Present value	No.	Present value	No.	Present value	No.	Present value
Tractor	0.13 (39.38)	19333	0.45 (36.15)	68166	0.90 (40.98)	181200	1.07 (43.34)	255417	1.38 (49.29)	446417	0.79 (43.94)	194107
Tractor drawn implements	0.18	603	1.32	20161	3.07	73450	4.20	96625	5.70	191182	2.89	76404
Irrigation Machinery	0.70	13812	1.05	43122	1.32	61347	2.03	89292	2.87	129938	1.59	67502
Combine Harvester & others	0.33	2847	0.65	5253	0.75	5768	0.85	38747	1.20	213023	0.76	53128

Figures in the parentheses indicate the average HP of the tractor

Table 3.1.8: Cropping pattern and cropping intensity on the sample farms, Punjab, 2012-13

(Ha / farm)

Crop	Marginal	Small	Semi-medium	Medium	Large	Overall
Kharif season						
Paddy	0.18	0.69	1.19	2.55	6.99	2.32
Basmati	0.10	0.21	0.41	0.81	2.33	0.77
Bt cotton	0.12	0.38	0.77	1.50	2.69	1.09
Sugarcane	0.03	0.08	0.24	0.34	1.44	0.42
Maize	0.10	0.08	0.18	0.30	0.51	0.23
Guara	0.01	0.04	0.03	0.15	0.35	0.12
Fodder	0.19	0.23	0.38	0.51	0.68	0.40
Vegetables	0.01	0.02	0.03	0.14	0.05	0.05
Green Manuring	-	-	0.03	0.33	0.72	0.22
Total	0.74	1.71	3.26	6.62	15.77	5.62
Rabi seasons						
Wheat	0.55	1.42	2.62	5.55	12.78	4.58
Barley	0.02	-	-	-	0.03	0.01
Rapeseed & mustard	-	0.01	-	0.01	0.11	0.02
Potato	-	-	-	0.22	0.61	0.17
Fodder	0.15	0.22	0.30	0.41	0.67	0.35
Vegetables	-	-	0.10	0.11	0.13	0.07
Sugarcane	0.03	0.07	0.24	0.34	1.44	0.42
Total	0.74	1.71	3.26	6.62	15.77	5.62
Zaid Season						
Spring Maize	-	0.02	0.06	0.12	0.39	0.12
Sunflower	-	-	-	0.45	0.87	0.26
Potato	-	-	-	0.39	1.59	0.40
Mentha	-	-	-	-	0.41	0.08
Vegetables	0.03	0.11	0.16	0.36	0.29	0.19
Total	0.03	0.13	0.22	1.32	3.55	1.05
Summer Season						
Fodder	0.02	0.02	0.03	0.05	0.05	0.03
Total	0.02	0.02	0.03	0.05	0.05	0.03
Gross cropped area	1.53	3.56	6.76	14.61	35.13	12.32
Cropping intensity (%)	207	208	208	221	222	219

Table 3.1.9: Cropping pattern of the sample farms, Punjab, 2012-13

(Percent to gross cropped area)

Crop	Marginal	Small	Semi-medium	Medium	Large	Overall
Kharif season						
Paddy	11.61	19.32	17.57	17.45	19.91	18.83
Basmati	6.67	5.82	5.99	5.57	6.63	6.26
Bt cotton	7.75	10.62	11.39	10.23	7.65	8.85
Sugarcane	1.74	2.10	3.50	2.30	4.11	3.44
Maize	6.51	2.25	2.71	2.03	1.45	1.90
Guara	0.65	1.12	0.39	1.00	1.01	0.94
Fodder	12.47	6.34	5.67	3.51	1.93	3.23
Vegetables	0.87	0.47	0.44	0.94	0.15	0.41
Green Manuring	-	-	0.49	2.28	2.05	1.77
Total	48.35	48.04	48.16	45.31	44.88	45.61
Rabi seasons						
Wheat	35.79	39.90	38.77	37.94	36.38	37.20
Barley	1.26	-	-	-	0.08	0.07
Rapeseed mustard	-	0.19	-	0.05	0.30	0.19
Potato	-	-	-	1.51	1.74	1.35
Fodder	9.56	6.03	4.41	2.78	1.90	2.81
Vegetables	-	-	1.48	0.73	0.38	0.55
Sugarcane	1.74	1.92	3.50	2.30	4.11	3.43
Total	48.35	48.04	48.16	45.31	44.88	45.61
Zaid Season						
Spring Maize	-	0.47	0.84	0.84	1.12	0.96
Sunflower	-	-	-	3.10	2.47	2.14
Potato	-	-	-	2.66	4.53	3.25
Mentha	-	-	-	-	1.16	0.66
Vegetables	1.95	3.04	2.37	2.46	0.84	1.54
Total	1.95	3.51	3.20	9.06	10.11	8.51
Summer Season						
Fodder	1.36	0.42	0.47	0.32	0.13	0.26
Total	1.36	0.42	0.47	0.32	0.13	0.26
Gross cropped area	100.00	100.00	100.00	100.00	100.00	100.00

3.2 Cost – return structure of major crops

3.2.1 Paddy

The physical input use in paddy cultivation on sample farms have been shown in Table 3.2.1. It is quite obvious that human labour use per hectare of paddy cultivation worked out to be 313.85 hours in an overall scenario while category wise analysis revealed that highest number of 344.33 hours were spent on human labour on medium farms followed by 317.89 hours on semi medium farms, 303.11 hours on small farms, 302.24 on large farms and 282.78 hours on marginal farms which were the lowest. The use of human labour was more on medium and semi medium farms due to higher availability of family and hired labour on these farms. In paddy cultivation human labour was mostly required in transplanting of seedlings, fertilization, plant protection measures and frequent irrigations. In case of machine labour (tractor), overall 13.14 hours were utilized in various field operations with highest (13.90 hrs.) on medium farms and lowest (12.68 hrs.) on small farms. Similarly, in overall scenario combine harvesting hours for paddy crop were 1.77 per hectare with highest on marginal (1.88 hrs.) and lowest on large (1.50 hrs.) farms. The irrigation hours using electric motor/ submersible pump were 255.97 per hectare in an overall situation while farm category wise analysis revealed that highest number (270.14 hours) of irrigation hours were utilized on raising paddy crop on marginal farms and lowest number (254.24 hours) on large farm category due to more under area under paddy crop. Diesel engine and generator hours utilized for irrigating one hectare of paddy crop on sample farms was estimated at10.07 and 11.11 hours, respectively. Diesel engine use in irrigating paddy crop was more on marginal (13.05 hrs.) farms while generator use was more on large (15.70 hrs) farms due to its higher availability on this farm category. Similarly, diesel consumption per hectare on owned and hired machinery taken together was 155.50 litres in overall scenario while the diesel consumption was highest on large (185.55 hrs.) farms and lowest on small (142.61 hrs.) farms due to higher use of diesel engine on small farms and that of generator on large farms. The proportion of hired machine use (including tractor) in terms of total diesel consumption per hectare was more on marginal farms vis-a-vis other farm categories. The yield obtained per hectare was 62.47 qtls. in an overall scenario while it was highest (64.58 qtls.) on medium farms and lowest (62.32 qtls.) on small farms among various farm categories.

Table 3.2.1: Physical input use in paddy cultivation on sample farms, Punjab, 2012-13

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	282.78	303.11	317.89	344.33	302.24	313.85
Machine use (Tractor)	13.32	12.68	13.50	13.90	13.07	13.14
Combine harvester	1.88	1.75	1.79	1.77	1.50	1.77
Irrigation (Electric motor/Submersible)	270.14	255.96	259.19	261.79	254.24	255.97
Diesel engine	13.05	7.90	6.47	7.88	7.29	10.07
Generator	3.47	4.99	9.26	12.98	15.70	11.11
Use of diesel (litre)						
Owned	86.94	97.17	139.85	133.32	165.96	124.76
Hired	55.67	47.44	24.71	24.33	19.59	30.74
Total	142.61	144.61	164.56	157.65	185.55	155.50
Seed (Kg)	14.86	13.24	14.34	15.38	14.54	14.47
Manure & Fertilisers (Kg)						
Urea	354.17	303.68	310.66	328.53	317.07	319.73
DAP	121.53	124.26	136.40	134.62	125.79	124.32
MOP	-	5.51	-	8.01	4.57	4.14
Zinc	20.83	14.49	16.62	20.51	19.45	18.25
Others	0.56	1.47	0.59	0.64	4.09	1.64
FYM (qtl)	16.80	8.70	17.70	22.20	5.40	13.80
Weedicides (No.)	0.78	1.03	0.76	0.98	0.88	0.90
Insecticides (No.)	2.17	2.03	2.53	3.33	3.00	2.69
Yield (Qt/ha)	63.47	62.32	63.42	64.58	63.49	62.47

The cost-return structure of paddy cultivation on sample farms has been shown in Table 3.2.2. A perusal of the table reveals that relative share of human labour use in total variable cost was 39.27 per cent in overall situation while according to farm category, on medium farms its share was 41 per cent which was highest and that on marginal farms it was 34.52 per cent, which was lowest among various farm categories. The per cent share of hired machine charges (except diesel) in total variable cost was 5.53 per cent in overall situation while on marginal farms its share was 14.84 per cent which was highest due to higher hired machine use on these farms while on large farms it was 3.31 per cent which was being lowest due to higher availability of owned machine on these farms. In overall, the proportionate share of diesel consumption in total variable cost was 23.47 per cent while its share was lowest (20.53%) on small farms and highest (27.86%) on large farms. Thus, diesel use in paddy cultivation was higher on large farms as compared to other farm categories. The total variable cost in paddy cultivation was estimated at Rs.30835 per hectare in overall scenario while farm category wise analysis revealed that total variable cost was highest (Rs.32629) on medium farms and lowest (Rs.30532) on small farms. The returns over variable cost (ROVC) in paddy cultivation were estimated at Rs.49626 in an overall scenario while these were highest (Rs. 50702) on semi-medium farms and lowest (Rs. 50034) on medium farms, however, the difference in returns among various farm categories was not so high. The benefit-cost (B:C) ratio was 1.61 in an overall scenario and it was highest (1.64) on small farms and lowest (1.53) on medium farms.

Table 3.2.2: Cost- return structure of paddy cultivation on sample farms, Punjab, 2012-13

(Rs/ha)

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent
Human labour	11076	34.52	11367	37.23	12438	40.06	13378	41.00	11702	37.72	12110	39.27
Machine use												
Hired Machine Charges*	4761	14.84	3852	12.62	1202	3.87	1210	3.71	1026	3.31	1706	5.53
Use of diesel												
Owned	4049	12.62	4525	14.82	6513	20.98	6209	19.03	7729	24.92	5810	18.84
Hired machinery	2593	8.08	1744	5.71	1151	3.71	1133	3.47	912	2.94	1432	4.64
Total	6641	20.70	6269	20.53	7664	24.68	7342	22.50	8641	27.86	7242	23.49
Seed	510	1.59	477	1.56	585	1.88	541	1.66	557	1.80	537	1.74
Manure & Fertilizers	6138	19.13	5420	17.75	5759	18.55	6023	18.46	5245	16.91	5666	18.38
Weedicides	599	1.87	582	1.90	478	1.54	480	1.47	503	1.62	519	1.68
Insecticides	1808	5.64	2041	6.68	2387	7.69	3093	9.48	2813	9.07	2525	8.19
Interest @ 7% for half the period of crop	552	1.72	525	1.72	534	1.72	561	1.72	534	1.72	530	1.72
Total variable cost	32084	100.00	30532	100.00	31047	100.00	32629	100.00	31019	100.00	30835	100.00
Gross returns	82384		80580		81748		82662		81267		80461	
ROVC	50300		50048		50702		50034		50248		49626	
Benefit-cost ratio	2.57		2.64		2.63		2.53		2.62		2.61	

*** Except diesel**

3.2.2 Basmati

The physical input use in basmati cultivation on sample farms have been shown in Table 3.2.3. A perusal of the table reveals that in overall, 462.47 human labour hours per hectare were spent on various farm related operations in basmati crop. The category-wise analysis revealed that highest numbers of 490.63 human labour hours were estimated to have been utilized in basmati cultivation on small farm category while lowest numbers of 452.84 hours were spent on medium farm category. Basmati is highly labour intensive crop and mostly labour is required for transplanting of seedlings, fertilization, plant protection measures, frequent irrigations and harvesting and threshing of the crop when harvested manually. The tractor use on sample farms was estimated at 16.22 hours per hectare in an overall situation while farm category wise analysis revealed that it was highest (18.05 hrs.) on large farms and lowest (14.03 hrs.) on marginal farm category. The combine harvester hours in overall were estimated at 0.97 hours per hectare while on marginal farms it was 1.70 hours due to large number of the sample farmers going for manual harvesting of basmati while these hours were lowest (0.54 hrs.) on semi-medium farms. The total irrigation hours using electric motor/ submersible pumps in basmati cultivation were 230.83 hours per hectare in an overall situation while these hours were 256.25 on large farms which were highest among various farm categories and 218.64 on marginal farms which were lowest. Diesel engine and generator hours utilized for irrigating basmati crop were estimated at 34.37 hours and 0.84 hours, respectively. Diesel engine use in irrigating basmati crop was more on marginal (53.18 hrs.) farms while generator use was highest on large (2.97 hrs) farms category. The diesel consumption per hectare including owned and hired machinery was 123.41 litres in overall situation. The category-wise analysis revealed that diesel consumption was highest on marginal (131.59 ltrs.) farms and lowest on medium (111.34 ltrs.) farms due to higher use of diesel engine on marginal farms as compared to other farm categories. On marginal farms higher (71.36 ltrs.) quantity of diesel was consumed by way of hiring farm machinery for various farm operations as compared to lowest (14.31 ltrs.) consumption on large farms. So, in basmati crop use of hired machinery for different farm operations declined with the increase in size of holding. The per hectare basmati yield obtained on the sample farms was estimated at 37.42 qtls in overall scenario while it was highest (39.42 qtls.) on medium farms and lowest (37 qtls.) on semi-medium farm category.

Table 3.2.3: Physical input use in basmati cultivation on sample farms, Punjab, 2012-13

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	476.36	490.63	454.33	452.84	475.39	462.47
Machine use (Tractor)	14.03	15.73	17.67	15.62	18.05	16.22
Combine harvester	1.70	0.68	0.54	1.20	0.90	0.97
Irrigation (Electric motor/Submersible)	218.64	246.88	240.17	254.42	256.25	230.83
Diesel engine	53.18	39.58	33.33	18.46	17.66	34.37
Generator	-	-	-	0.67	2.97	0.84
Use of diesel (litre)						
Owned	60.23	92.08	91.13	96.44	97.58	92.08
Hired	71.36	28.53	29.04	14.90	14.31	31.33
Total	131.59	120.61	120.17	111.34	111.89	123.41
Seed (Kg)	14.55	14.79	13.33	12.69	16.88	14.51
Manure & Fertilizers (Kg)						
Urea	193.18	187.50	175.00	206.73	218.75	196.83
DAP	62.50	85.42	87.50	67.31	98.44	81.72
MOP	2.27	2.08	8.33	5.77	14.84	7.28
Zinc	14.77	8.54	13.33	17.79	13.75	13.68
Other	13.41	8.65	5.00	4.71	5.94	7.20
FYM (qtl)	-	12.50	40.00	23.08	-	15.67
Weedicides (No.)	0.91	0.92	0.83	0.92	1.19	0.96
Insecticides (No.)	3.27	3.58	3.33	3.85	4.00	3.63
Yield (Qtl/ha)						
Main	37.66	38.38	37.00	39.42	38.79	37.42
By product	24.09	26.88	23.67	26.46	25.94	24.51

The cost-return structure of basmati cultivation on sample farms has been given in Table 3.2.4. It is quite obvious from the table that in an overall scenario, relative share of human labour use in total variable cost was 48.52 per cent in overall situation while farm category wise analysis revealed that on large farms its share was highest (51.74%) and it was lowest (44.28%) on marginal farms which showed that there was more use of human labour on large farms during various farm operations in basmati cultivation as compared to other farm categories. The per cent share of hired machine charges (Except diesel) in total variable cost was 4.64 per cent in overall situation while farm category wise analysis revealed that on marginal farms its share was 12.81 per cent which was highest and that on large farms it was 1.28 per cent which was lowest. The relative share of diesel consumption in total variable cost was found to be 17.26 per cent in an overall scenario while according to the various farm categories, its share was lowest (15.22%) on large farms and highest (18.17%) on marginal farm category. Thus, diesel use was more on marginal farms in basmati cultivation due to higher use of hired machinery as compared to other farm categories. The total variable cost in basmati cultivation was worked out at Rs.33296 per hectare in overall situation while it was highest (Rs.34229) on large farms and lowest (Rs.31600) on medium farm category. The returns over variable cost (ROVC) in basmati cultivation were estimated at Rs.56898 in an overall scenario. However, returns were highest (Rs.64061) on small farms and lowest (Rs.55725) on semi-medium farms due to lower gross returns as compared to other farm categories. In overall, benefit-cost (B:C) ratio was 1.71 in basmati cultivation while farm category wise analysis revealed that benefit-cost ratio was highest (1.97) on medium farms and lowest (1.68) on large farms due to higher total variable cost and lower gross returns on this farm category.

Table 3.2.4: Cost- return structure of basmati cultivation, sample farmers, Punjab, 2012-13

Rs/ha

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent
Human Labour	14933	44.28	15383	47.00	15107	46.88	15774	49.92	17710	51.74	16154	48.52
Machine use												
Hired Machine Charges*	4320	12.81	2016	6.16	1749	5.43	502	1.59	438	1.28	1546	4.64
Use of diesel												
Owned	2805	8.32	4288	13.10	4244	13.17	4491	14.21	4544	13.28	4288	12.88
Hired machinery	3323	9.85	1329	4.06	1352	4.20	794	2.51	666	1.95	1459	4.38
Total	6128	18.17	5617	17.16	5596	17.37	5285	16.73	5211	15.22	5747	17.26
Seed	745	2.21	923	2.82	917	2.84	910	2.88	1222	3.57	961	2.89
Manure & Fertilizers	3360	9.96	4512	13.79	4753	14.75	4311	13.64	4575	13.37	4353	13.07
Weedicides	580	1.72	500	1.53	477	1.48	510	1.61	648	1.89	545	1.64
Insecticides	3077	9.13	3217	9.83	3074	9.54	3764	11.91	3836	11.21	3416	10.26
Interest @ 7% for half the period of crop	580	1.72	563	1.72	554	1.72	543	1.72	589	1.72	573	1.72
Total variable cost	33723	100.00	32730	100.00	32227	100.00	31600	100.00	34229	100.00	33296	100.00
Gross returns												
Main	94248		95156		86580		92322		89766		88638	
By product	1397		1635		1373		1612		1805		1556	
Total	95645		96792		87953		93934		91570		90194	
ROVC	61922		64061		55725		62334		57342		56898	
Benefit-cost ratio	2.84		2.96		2.73		2.97		2.68		2.71	

*** Except diesel**

3.2.3 Cotton

The physical input use in cotton cultivation on the sample farms have been shown in Table 3.2.5. It is quite obvious from the table reveals that overall 547.95 human labour hours were estimated to be have been utilized while raising cotton crop on the sample farms. The category-wise analysis revealed that highest (576.75 hrs.) number of labour hours were spent on large farms while lowest (500.26 hrs.) on the marginal farms. This shows the higher availability of the labour on large farms for undertaking various field operations in cotton crop. Labour is required to undertake various field operations such as; sowing, fertilization, plant protection measures and picking of cotton. The tractor use was 25.15 hours in overall scenario while on large farms tractor was used for 35 hours which was highest and 20.52 hours on marginal farms which were lowest among various farm categories. The irrigation hours estimated for the use of electric motor/ submersible pump were 27.03 hours while farm category wise analysis revealed that on large farms irrigation hours were highest (29.33 hrs.) and on marginal farms lowest (26.21hrs.). Diesel engine and generator were used for irrigation purpose by some of the respondents as supplementary source of irrigation and their use was estimated at 15.03 and 5.50 hours respectively, in an overall scenario. The diesel engine use was more than generator use on various farm size categories for irrigation in cotton crop. The total diesel consumption in cotton cultivation in overall situation was estimated at 118.64 litres constituting 91.15 litres from owned and 27.49 litres from hired sources. On large farms, the diesel consumption from owned sources was 129.50 litres which was maximum on all the farm categories while on marginal farms diesel consumption was 41.63 litres and it was minimum level of diesel consumption from owned sources. The diesel consumption through hired sources was 76.73 litres per hectare on marginal farms which was highest among all the farm categories while no hired diesel consumption was on large farms. There was not much variation in cotton yield obtained on various farm categories. In overall, cotton yield was estimated at 16.52 qtls per hectare with a maximum of 16.96 qtls on marginal and a minimum of 16.14 qtls on medium farm size category.

Table 3.2.5: Physical input use in cotton cultivation on sample farms, Punjab, 2012-13

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	500.26	550.00	541.15	560.59	576.75	547.95
Machine use (Tractor)	20.52	20.83	21.77	30.49	35.00	25.15
Irrigation (Electric motor/Submersible)	26.21	28.68	27.08	27.39	29.33	27.03
Diesel engine	11.88	15.00	15.83	18.06	17.50	15.03
Generator	1.67	1.18	7.36	9.86	8.67	5.50
Use of diesel (litre)						
Owned	41.63	73.60	90.45	114.10	129.50	91.15
Hired	76.73	33.99	24.15	12.17	0.00	27.49
Total	118.36	107.59	114.60	126.29	129.50	118.64
Seed (kgs)	4.20	4.423	4.212	4.486	4.158	4.305
Manure & Fertilisers (Kg)						
Urea	296.88	268.38	270.83	253.47	258.33	267.97
DAP	125.00	120.59	128.47	120.83	118.17	120.00
MOP	-	7.35	6.94	13.89	7.17	7.03
Zinc	3.13	2.94	10.42	5.97	5.00	5.72
Other	20.83	-	13.89	0.35	2.17	6.73
FYM (qtl)	8.70	11.10	11.70	7.50	9.90	10.90
Weedicides (No.)	0.75	0.65	0.72	1.06	1.07	0.85
Insecticides (No.)	5.17	6.29	5.39	5.61	6.07	5.73
Yield (Qtl/ha)						
Main	16.96	16.84	16.72	16.14	16.25	16.52
By product	37.71	47.79	53.47	49.86	50.33	48.50

The cost-return structure of cotton cultivation on sample farms has been shown in Table 3.2.6. It is quite obvious from the table that relative share of human labour in total variable cost was 35.62 per cent while among various farm categories the highest (38.13%) share was on large farms while the lowest (32.91%) share was on marginal farms. This shows the greater availability of human labour with increase in the farm size. The hired machine charges (Excluding diesel charges) were 3.03 per cent of the total variable cost in overall situation while category-wise analysis showed that highest share (8.04%) was on marginal farms and there was no hired machine use on large farms. The relative share of diesel use was 11.70 per cent of total variable cost in overall scenario which constituted 8.99 per cent from owned sources and 2.71 per cent from hired one. The highest share (12.47%) of diesel use in total variable cost was on medium farms while lowest share (10.80%) was found on small farms. The total variable cost was estimated at Rs. 47225 per hectare in overall situation while among various farm size categories, highest total variable cost (Rs.49663) was estimated at large farms and lowest (Rs.46271) at marginal farms. In overall, the returns over variable cost (ROVC) worked out to be Rs.24883 per hectare from cotton cultivation with highest (Rs.30048) on marginal farms and lowest (Rs.21809) on large farms due to lower gross returns and higher total variable cost on large farms. The benefit-cost (B:C) ratio was 1.53 in an overall situation in cotton cultivation while farm category wise analysis brought out that B:C ratio was highest (1.65) on marginal and lowest (1.44) on large farms.

Table 3.2.6: cost-return structure of cotton cultivation on sample farms, Punjab, 2012-13

(Rs/ha)

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent
Human Labour	15230	32.91	16437	35.41	15838	34.58	17461	37.04	18939	38.13	16821	35.62
Machine use												
Hired Machine Charges*	3718	8.04	2093	4.51	1841	4.02	193	0.41	0	0.00	1433	3.03
Use of diesel												
Owned	1939	4.19	3428	7.38	4212	9.20	5314	11.27	6031	12.14	4245	8.99
Hired	3573	7.72	1583	3.41	1125	2.46	567	1.20	0	0.00	1280	2.71
Total	5512	11.91	5010	10.80	5337	11.65	5880	12.47	6031	12.14	5525	11.70
Seed	5750	12.43	5824	12.55	5406	11.80	6333	13.43	6008	12.10	5868	12.43
Manure & Fertilizers	9214	19.91	8994	19.38	9926	21.67	8445	17.91	9461	19.05	9442	19.99
Weedicides	490	1.06	463	1.00	497	1.09	747	1.58	737	1.48	590	1.25
Insecticides	5563	12.02	6794	14.64	6174	13.48	7271	15.42	7633	15.37	6734	14.26
Interest @ 7% for half the period of crop	796	1.72	798	1.72	788	1.72	811	1.72	854	1.72	812	1.72
Total variable cost	46271	100.00	46414	100.00	45806	100.00	47141	100.00	49663	100.00	47225	100.00
Gross returns												
Main	74204		71991		70642		70050		68543		69815	
By product	2116		2139		2248		2069		2929		2293	
Total	76320		74130		72890		72120		71472		72108	
ROVC	30048		27716		27083		24979		21809		24883	
Benefit-cost ratio	1.65		1.60		1.59		1.53		1.44		1.53	

*** Except diesel**

3.2.4 Sugarcane

The physical input use in sugarcane cultivation has been given in Table 3.2.7. A perusal of the table reveals that in overall, 1122.92 human labour hours per hectare were spent on various sugarcane cultivation related farm operations. The farm category wise analysis revealed that on large farms maximum i.e. 1063.07 labour hours were utilized to undertake various farm operations while on marginal farms labour hours spent were 952.50, which were minimum among all the farm categories. This shows that sugarcane is highly labour intensive crop and major farm operations included; sowing, fertilization, plant protection measures, harvesting, loading, transportation and marketing. The tractor hours spent on various farm operations were 22.23 in an overall situation while among various farm categories, a maximum of 22.72 hours was the tractor use on large farms and a minimum of 16.46 hours on marginal farms. As irrigation is very crucial for raising each crop, therefore, in sugarcane cultivation also 138.06 hours were spent during irrigation using electric motor/ submersible pump while category wise analysis revealed that a maximum of 146.09 hours were utilized on large farms and a minimum of 137.50 hours were spent for irrigating sugarcane crop on small farms. On the other hand, diesel engine and generator use was for 9.82 and 13.91 hours for irrigating sugarcane fields in overall situation while generator use was maximum (13.13 hrs.) on large farms and minimum (6.67 hrs.) on small farms. The diesel engine use was 20.11 hours on semi-medium farms which was maximum among various farm categories. In overall, 192 litres of diesel was consumed per hectare in sugarcane cultivation with 176.59 litres from owned sources and 15.41 litres while using hired machinery. The category-wise analysis revealed that a maximum of 205.91 litres of diesel was consumed for various farm operations on medium farms while on small farms diesel use was 191.76 litres which was minimum among various farm categories. The proportion of diesel consumption from hired sources was more on marginal and small farms as compared to other farm categories. The sugarcane yield obtained was 832.29 quintals per hectare in an overall situation while among various farm categories highest cane yield (859.04 qtls.) was obtained on medium farms and lowest (820.83 qtls) on marginal farms.

Table 3.2.7: Physical input use in sugarcane cultivation on sample farms, Punjab, 2012-

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	952.50	1084.50	1072.16	1047.47	1063.07	1122.92
Machine use (Tractor)	16.46	20.38	21.19	22.53	22.72	22.23
Irrigation (Electric motor/Submersible)	139.17	137.50	137.73	139.81	146.09	138.06
Diesel engine	-	-	20.11	16.35	2.34	9.82
Generator	6.67	7.00	15.68	8.46	13.13	13.91
Use of diesel (litre)						
Owned	110.00	138.38	186.65	190.53	192.15	176.59
Hired	83.75	53.38	8.76	15.38	1.30	15.41
Total	193.75	191.76	195.41	205.91	193.45	192.00
Seed (qtls)	83.33	85.00	90.90	90.38	87.11	88.41
Manure & Fertilizers (Kg)						
Urea	445.54	425.00	446.36	500.00	492.19	450.52
DAP	270.00	280.00	284.09	292.50	269.53	273.96
MOP	0.00	12.50	17.05	4.81	23.44	14.32
Zinc	13.33	10.00	4.55	3.85	7.81	7.81
Others	-	-	1.14	-	39.06	13.28
FYM (qtl)	-	-	62.27	69.23	23.44	50.00
Weedicides (No.)	1.00	0.80	0.82	1.23	0.88	0.96
Insecticides (No.)	2.00	2.20	2.36	2.31	3.06	2.54
Yield (qtl/ha)						
Main	820.83	850.50	840.27	859.04	858.13	832.29
By product	91.67	87.50	82.29	89.42	86.72	88.54

The cost and return structure of sugarcane cultivation has been given in Table 3.2.8. A perusal of the table reveals that the share of human labour in total variable cost was 46.79 per cent. The farm category-wise analysis showed that on medium farms the share of human labour in total variable cost was 47.44 per cent which was highest while on marginal farms this share was 42.25 per cent which was lowest. The proportion of hired machine charges (Excluding diesel) in total variable cost was just 2.05 per cent in overall situation and this proportion declined with farm size with maximum (11.43%) on marginal farms and minimum (0.12%) on large farm category. The relative share of diesel use in total variable cost was found to be 8.60 per cent with larger share from owned machinery (7.91%) and smaller share from hired machine use (0.69%). The farm category wise analysis revealed that share of diesel consumption in total variable cost was highest (9.13%) on marginal farms and lowest (8.93%) on small farm category. This shows that farmers on small farms were using diesel judiciously as compared to their counterparts. Overall, total variable cost in sugarcane cultivation was estimated at Rs. 104012 per hectare with a maximum of Rs.105303 on medium farms and a minimum of Rs.99842 on marginal farms. The returns over variable cost (ROVC) in sugarcane cultivation were Rs. 110258 per hectare in overall situation while among various farm categories; returns were Rs.118775 on small farms which were highest among farm categories and Rs. 112783 on marginal farms which were lowest. Overall, benefit-cost (B:C) ratio was 2.06 in sugarcane cultivation with 2.19 on small farms, which was maximum and 2.10 on medium farms, which was lowest among various farm categories.

Table 3.2.8: Cost - return structure of sugarcane cultivation on sample farms, Punjab, 2012-13

(Rs/ha)

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent
Human Labour	41757	42.25	43893	43.90	45012	45.06	49960	47.44	48009	46.29	48663	46.79
Machine use												
Hired Machine Charges*	11300	11.43	3964	3.97	1398	1.40	2059	1.96	126	0.12	2132	2.05
Use of diesel												
Owned	5123	5.18	6444	6.45	8692	8.70	8873	8.43	8948	8.63	8224	7.91
Hired machinery	3900	3.95	2486	2.49	408	0.41	716	0.68	61	0.06	718	0.69
Total	9023	9.13	8930	8.93	9100	9.11	9589	9.11	9009	8.69	8941	8.60
Seed	18750	18.97	24750	24.76	24943	24.97	22894	21.74	25113	24.21	24038	23.11
Seed treatment	1250	1.26	1450	1.45	682	0.68	996	0.95	1395	1.35	1120	1.08
Manure & Fertilizers	9286	9.39	9356	9.36	10606	10.62	10784	10.24	10165	9.80	10193	9.80
Weedicides	833	0.84	800	0.80	756	0.76	1327	1.26	1008	0.97	1004	0.97
Insecticides	3300	3.34	3450	3.45	4023	4.03	4133	3.92	5391	5.20	4404	4.23
Interest @ 7% for half the period of crop	3342	3.38	3381	3.38	3378	3.38	3561	3.38	3508	3.38	3517	3.38
Total variable cost	98842	100.00	99975	100.00	99898	100.00	105303	100.00	103723	100.00	104012	100.00
Returns												
Main	205208		212625		210063		214760		214533		208073	
By product	6417		6125		5760		6259		6070		6198	
Total	211624		218750		215823		221019		220603		214270	
ROVC	112783		118775		115925		115717		116880		110258	
Benefit-cost ratio	2.14		2.19		2.16		2.10		2.13		2.06	

*** Except diesel**

3.2.5 Maize

The physical input use in maize cultivation on the sample farms have been depicted in Table 3.2.9. A perusal of the table reveals that overall 311.84 human labour hours were used while conducting various farm operations in maize crop on the sample farms. The category-wise analysis revealed that highest (314.27 hrs.) numbers of labour hours were spent on large farms for raising maize crop while lowest (283.50 hrs.) on the small farms. This shows the higher availability of labour on large farms for undertaking various farm operations as compared to other farm categories. Overall, tractor use was 11.19 hours in undertaking various cultivation practices in maize cultivation while among various farm categories, on medium farms tractor use was 14.20 hours, which was maximum and 8.39 hours on marginal farms which was minimum. The combine harvester use was 1.29 hours in overall scenario while a maximum of 2.35 hours were spent on small farm category during harvesting using combine harvester. On the other hand combine harvester was not used on semi-medium farms for maize harvesting. The irrigation hours estimated on the use of electric motor/ submersible pumps were 33.88 hours in overall situation while on large farms, these were highest (38.75 hrs.) and lowest on small farms (31.25 hrs.). Diesel engine and generator were used for irrigation purpose by some of the respondents and their use was estimated at 6.54 and 6.20 hours respectively in an overall scenario. The diesel engine use was highest (10.25 hrs.) on semi-medium farms among various farm size categories while generator use for irrigating maize crop was maximum (8.23 hrs.) on medium farms. The total diesel consumption on the sample farms in overall scenario was 125.83 litres in maize cultivation constituting 94.41 litres from owned sources and 31.42 litres from hired machinery. The farm category-wise analysis revealed that highest (139.02 litrs.) diesel consumption was on small farms and lowest (92.08 ltrs.) on marginal farms. On medium farms, the diesel consumption from owned sources was 115.75 litres which was maximum among various farm categories while on marginal farms diesel consumption was 24.91 litres and it was minimum level of diesel consumption from owned sources. The diesel consumption from hired machinery was 67.17 litres per hectare on marginal farms, which was highest among all the farm categories, while a minimum of 10.42 litres was the hired diesel consumption on large farms. The highest yield (43.63 qtls) of maize was on semi-medium farms and lowest (40.79 qtls) on medium farms while in an overall situation, 42.32 quintal was the maize yield on sample farms.

Table 3.2.9: Physical input use in maize cultivation on sample farms, Punjab, 2012-13

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	295.51	283.50	299.89	309.19	314.27	311.84
Machine use (Tractor)	8.39	9.58	12.13	14.20	10.67	11.19
Combine Harvester	2.16	2.35	-	1.25	1.04	1.29
Electric motor/Submersible	34.77	31.25	36.88	32.92	38.75	33.88
Diesel engine	2.73	-	10.25	7.29	5.00	6.54
Generator	6.82	8.00	4.69	8.23	6.33	6.20
Use of diesel (litre)						
Owned	24.91	93.08	101.56	115.75	112.47	94.41
Hired	67.17	45.94	12.40	23.18	10.42	31.42
Total	92.08	139.02	113.96	138.93	122.89	125.83
Seed (kg)	22.27	23.75	23.13	29.58	21.46	24.20
Seed treatment	0.23	-	-	0.21	0.42	0.21
Manure & Fertilizers (Kg)						
Urea	240.32	265.63	250.00	296.88	260.42	252.93
DAP	101.14	93.75	193.75	183.33	145.83	148.67
MOP	2.27	-	-	15.63	-	4.52
Zinc	-	-	-	6.25	-	1.60
Other	-	-	-	2.29	0.42	0.69
FYM (qtl)	27.27	-	18.75	25.00	-	15.96
Weedicides (No.)	0.91	1.00	0.63	1.17	0.58	0.85
Insecticides (No.)	0.73	1.00	0.75	1.58	1.42	1.15
Yield (qtl/ha)						
Main	42.50	41.50	43.63	40.79	40.83	42.32
By product	14.09	12.00	10.00	8.25	9.92	9.06

The cost-return structure of maize cultivation on sample farms has been given in Table 3.2.10. It is clear from the table that the relative share of human labour in total variable cost was 35.67 per cent in overall situation while according to farm categories; this share was highest (37.73%) on large farms and lowest (32.74%) on medium farms. The hired machine charges (Excluding diesel charges) were 5.59 per cent of the total variable cost in overall scenario while category wise analysis revealed that highest share (15.99%) was on marginal farms and lowest (1.74%) share on large farm category. In overall, the relative share of diesel use in total variable cost was 19.39 per cent of total variable cost further constituting 14.55 per cent from owned sources and 4.84 per cent from hired machinery. The highest share (22.21%) of diesel use in total variable cost was on small farms and lowest share (15.44%) on

marginal farms. The total variable cost was estimated at Rs.30217 per hectare in an overall situation while according to farm size categories, total variable cost was Rs 32606 per hectare on medium farms, which was highest, however, Rs. 28467 was the total variable cost on large farms which was lowest. In overall, the returns over variable cost (ROVC) were about Rs.21019 per hectare from maize cultivation while farm category-wise analysis showed that returns were highest (Rs.23869) on semi-medium farm category and lowest (Rs.16372) on medium farms. The benefit-cost (B:C) ratio in maize cultivation was 1.70 in an overall scenario, while according to farm size category, B:C ratio was highest (1.83) on semi-medium farms and lowest (1.69) on marginal farms.

Table 3.2.10: Cost- return structure of maize cultivation on sample farms, Punjab, 2012-13

(Rs/ha)

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	**percent**	**Value**	**percent**	**Value**	**percent**	**Value**	**percent**	**Value**	**percent**	**Value**	**percent**
Human Labour	10396	33.76	9923	34.05	10361	36.10	10676	32.74	10742	37.73	10777	35.67
Machine use												
Hired Machine Charges*	4925	15.99	3142	10.78	704	2.45	1143	3.51	494	1.74	1689	5.59
Use of diesel												
Owned	1160	3.77	4335	14.87	4730	16.48	5390	16.53	5238	18.40	4397	14.55
Hired machinary	3597	11.68	2139	7.34	577	2.01	1079	3.31	485	1.70	1463	4.84
Total	4757	15.44	6474	22.21	5307	18.49	6470	19.84	5723	20.10	5860	19.39
Seed & seed treatment	4277	13.89	4264	14.63	4781	16.66	4833	14.82	4494	15.79	4489	14.86
Manure & Fertilizers	4213	13.68	3684	12.64	6250	21.78	6925	21.24	5073	17.82	5369	17.77
Weedicides	898	2.91	813	2.79	459	1.60	738	2.26	452	1.59	661	2.19
Insecticides	805	2.61	344	1.18	344	1.20	1260	3.87	1000	3.51	853	2.82
Interest @ 7% for half the period of crop	530	1.72	501	1.72	494	1.72	561	1.72	490	1.72	520	1.72
Total variable cost	30799	100.00	29144	100.00	28700	100.00	32606	100.00	28467	100.00	30217	100.00
Returns												
Main	51000		49593		51920		48459		48384		50657	
By product	986		780		650		520		645		580	
Total	51986		50373		52570		48978		49028		51237	
ROVC	21187		21228		23869		16372		20561		21019	
Benefit-cost ratio	1.69		1.73		1.83		1.50		1.72		1.70	

*** Except diesel**

3.2.6 Wheat

The physical input use in wheat cultivation on the sample farms have been shown in Table 3.2.11. It is quite obvious from the table that overall 124.53 human labour hours per hectare were estimated to be have been used while raising wheat crop. The category wise analysis revealed that highest (133.58 hrs.) number of labour hours were spent on marginal farms while lowest (112.92 hrs.) on the large farms. Thus, human labour use declined with increase in farm size in wheat crop. The tractor use was 20.13 hours in overall scenario while on medium farms it was 22.87 hours which was highest among various farm categories and 17.88 hours on marginal farms which was lowest. The average combine harvester hours were 2.33 hours per hectare for harvesting in overall while on marginal farms combine harvesting hours were highest (2.69 hrs.) and lowest (1.89 hrs.) on large farms. The irrigation hours worked out on the basis of electric motor/ submersible pump use were 54.14 hours in overall scenario while on marginal farms these were highest (58.75 hrs.) and on semi-medium farms lowest (53.48 hrs.). Diesel engine and generator were used as additional source of irrigation by some of the respondents and their use was estimated at 5.43 and 1.07 hours respectively, in an overall scenario. The diesel engine use for irrigation on various farm size categories was higher as compared to generator use for irrigating wheat crop. The diesel engine use was maximum (8.05 hrs.) on marginal farms and generator use (1.58 hrs.) on semi-medium farms. The total diesel consumption in wheat crop on the sample farms in overall scenario was 144.13 litres constituting 75.14 litres from owned and 68.99 litres from hired sources. The farm category-wise analysis revealed that total diesel use in wheat cultivation on semi-medium farms was 147.52 litres which was highest as compared to 129.39 litres on marginal farms which was lowest. On large farms, the diesel consumption from owned sources was 97.18 litres which was maximum on all the farm size categories while on marginal farms diesel consumption was 35.46 litres and it was minimum level of diesel consumption from owned sources. The diesel consumption through hired sources was 93.93 litres per hectare on marginal farms which was highest among all the farm categories while lowest (48.19 ltrs.) diesel consumption was on large farms. The average yield obtained on the sample farms in overall scenario was 44.62 quintals per hectare while wheat grain yield was highest (45.71 qtls.) on large farms and lowest (43.17 qtls.) on marginal farms.

Table 3.2.11: Physical input use in wheat cultivation on sample farms, Punjab, 2012-13

(Hours/ha)

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
Human Labour	133.58	127.47	121.12	120.01	112.92	124.53
Machine use (Tractor)	17.88	18.96	21.01	22.87	22.52	20.13
Combine harvester	2.69	2.48	2.32	2.32	1.89	2.33
Irrigation (Electric motor/Submersible)	58.75	56.90	53.48	56.69	54.46	54.14
Diesel engine	8.05	3.17	5.13	6.82	4.21	5.43
Generator	0.77	0.69	1.58	1.48	0.81	1.07
Use of diesel (litre)						
Owned	35.46	62.21	77.66	86.97	97.18	75.14
Hired	93.93	72.89	69.86	50.35	48.19	68.99
Total	129.39	135.10	147.52	137.32	145.37	144.13
Seed (Kg)	108.64	107.00	105.79	107.20	107.29	107.16
Manure & Fertilizers (Kg)						
Urea	252.27	289.79	266.46	288.14	301.25	280.02
DAP	132.95	139.17	137.29	141.95	138.75	138.10
MOP	1.14	1.04	1.04	2.12	-	1.06
Zinc	0.91	0.83	0.63	1.27	0.63	0.85
Other	0.05	-	0.08	0.59	2.88	0.73
FYM (qtl)	20.45	10.00	21.25	6.99	16.25	14.92
Weedicides (No.)	0.55	0.63	0.65	0.81	0.70	0.67
Insecticides (No.)	1.53	1.67	1.73	1.68	1.92	1.71
Yield (Qtl./ha)						
Main	43.17	44.81	45.50	43.76	45.71	44.62
By product	33.82	35.25	33.00	33.54	32.65	33.65

The cost-return structure of wheat cultivation has been given in Table 3.2.12. The results shown in the table reveals that in overall, share of human labour in total variable cost was 19.10 per cent. The category-wise analysis revealed that on medium farms the share of human labour in total variable cost was 19.91 per cent which was highest while on marginal farms this share was 18.19 per cent, which was lowest among different farm categories. The proportion of hired machine charges (Excluding diesel) in total variable cost was 14.60 per cent in an overall scenario and this proportion declined with farm size with maximum (23.79%) on marginal farms and minimum (10.97%) on large farm category. The relative share of diesel use in total variable cost was found to be 26.28 per cent with 13.7 per cent share from owned machinery and 12.58 per cent from hired machine use. The farm category wise analysis revealed that share of diesel consumption in total variable cost was highest (27.52%) on large farms and lowest (22.39%) on marginal farm category. This shows that farmers on marginal farms were using diesel judiciously as compared to their counterparts from other farm categories. In overall, total variable cost on the sample farms was worked out at Rs. 25542 per hectare while farm category wise analysis revealed that variable cost was highest (Rs.26909) on marginal farms and lowest (Rs. 24538) on medium farm category. The returns over variable cost (ROVC) in wheat cultivation were estimated at Rs. 39806 per hectare in overall scenario and Rs.40330 on large farms which were highest among farm categories and Rs. 35422 on marginal farms which were lowest. Overall, benefit-cost (B:C) ratio was 2.56 in wheat cultivation while it was 2.64 on large farms, which was highest and 2.32 on marginal farms which was lowest among various farm categories.

Table 3.2.12: cost-return structure of wheat cultivation on sample farms, Punjab, 2012-13

(Rs/ha)

Particulars	Marginal		Small		Semi medium		Medium		Large		Overall	
	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent	Value	percent
Human Labour	4894	18.19	4927	19.37	4725	18.85	4885	19.91	4618	18.77	4879	19.10
Machine use												
Hired Machine Charges*	6402	23.79	3828	15.05	3332	13.29	2846	11.60	2699	10.97	3728	14.60
Use of diesel												
Owned	1651	6.14	2897	11.39	3617	14.43	4050	16.51	4526	18.40	3499	13.70
Hired	4374	16.26	3394	13.34	3254	12.98	2345	9.56	2244	9.12	3213	12.58
Total	6026	22.39	6292	24.73	6871	27.41	6395	26.06	6770	27.52	6712	26.28
Seed	2580	9.59	2610	10.26	2722	10.86	2693	10.98	2743	11.15	2671	10.46
Manure & Fertilizers	4804	17.85	5067	19.92	4959	19.78	5180	21.11	5136	20.88	5032	19.70
Weedicides	764	2.84	957	3.76	803	3.20	924	3.77	863	3.51	864	3.38
Insecticides	978	3.63	1321	5.19	1228	4.90	1192	4.86	1347	5.47	1217	4.76
Interest @ 7% for half the period of crop	463	1.72	438	1.72	431	1.72	422	1.72	423	1.72	439	1.72
Total variable cost	26909	100.00	25438	100.00	25071	100.00	24538	100.00	24599	100.00	25542	100.00
Gross returns												
Main	55471		57584		58462		55471		57584		58462	
By product	6860		7335		6882		6860		7335		6882	
Total	62331		64919		65344		62331		64919		65344	
ROVC	35422		38496		39090		37793		40330		39806	
Benefit-cost ratio	2.32		2.55		2.61		2.54		2.64		2.56	

*** Except diesel**

3.2.7 Sunflower

The physical input use in sunflower cultivation on the sample farms have been given in Table 3.2.13. A perusal of the table reveals that overall 218.48 human labour hours per hectare were estimated to have been used in overall situation on the sample farms in sunflower cultivation while farm category wise analysis revealed that 225.21 human labour hours were spent on medium farms and 203.44 hours on large farm categories. The tractor use in various farm operations worked out to be 18.95 hours in overall scenario while a minimum of 17.92 hours tractor use was estimated on medium and 19.72 on large farm category. Also, combine harvester was used to harvest sunflower crop and 2.5 hours per hectare were spent on the sample farms on this particular operation. For irrigating sunflower crop, electric motor/ submersible pumps were used for 82.36 hours per hectare on the sample farms while on medium farm category these hours were 84.17 and 81.25 on large farm category. In overall, generator was also used for 5.64 hours for irrigation purpose as a supplementary source of irrigation while on medium farm category generator use was 6 hours and 5.63 hours on large farms. The total consumption of diesel for various farm operations in sunflower crop was estimated at 175.73 litres constituting 147.05 litres from owned sources and 28.68 litres from hired machine use. The farm category-wise diesel consumption varied from 174.46 litres on medium farms to 182.83 litres on large farms. In overall situation, the sunflower grain yield estimated on the sample farms was 17.11 quintals per hectare while on large farms, yield obtained was 17.81 quintals and on medium farms 16.85 quintals.

Table 3.2.13: Physical input use of sunflower cultivation, sample farmers, Punjab, 2012-13

(Hours/ha)

Particulars	Medium	Large	Overall
Human Labour	225.21	203.44	218.48
Machine use (Tractor)	17.92	19.72	18.95
Combine harvester	2.50	2.50	2.50
Electric motor/Submersible	84.17	81.25	82.36
Diesel engine	-	-	-
Generator	6.00	5.63	5.64
Use of diesel (litre)			
Owned	143.39	155.31	147.05
Hired	31.07	27.52	28.68
Total	174.46	182.83	175.73
Seed (kg.)	4.17	4.38	4.29
Seed treatment	-	0.63	0.36
Manure & Fertilisers (Kg.)			
Urea	250.00	292.50	285.71
DAP	83.33	125.00	107.14
Weedicides (No.)	0.67	0.25	0.43
Insecticides (No.)	2.33	2.00	2.14
Yield (qtl/ ha)	16.85	17.81	17.11

The cost-return structure of sunflower cultivation has been depicted in Table 3.2.14. It is quite obvious from the table that the relative share of human labour use in sunflower cultivation was estimated at 28.13 per cent of total variable cost while on medium category farms, the proportionate share of human labour was 29.17 per cent and 26.39 per cent on large farms. The relative share of hired machine charges (Except diesel) in total variable cost was 5.45 per cent in overall situation while this share was 5.24 per cent on medium and 5.51 per cent on large farm categories. The share of diesel use in total variable cost in sunflower

cultivation was 29.32 per cent constituting 24.54 per cent from owned sources and 4.79 per cent from hired one. The category wise analysis revealed that on medium farms share of diesel consumed on various farm operations in sunflower cultivation was 28.93 per cent and on large farms this share was 30.65 per cent. The total variable cost was worked out at Rs. 27907 per hectare in overall scenario and Rs 28045 on medium and Rs. 27779 on large farm categories. The returns over variable cost (ROVC) in sunflower cultivation worked out to be Rs.16322 per hectare while on medium farms the returns were Rs.15597 and on large farms Rs.17868 per hectare. In overall, benefit-cost (B:C) ratio was 1.58 in sunflower cultivation while on medium farms this ratio was 1.56 and 1.64 on large farm category.

Table 3.2.14: Cost- return structure of sunflower cultivation on sample farmers, Punjab, 2012-13

(Rs/ha)

Particulars	Medium		Large		Overall	
	Value	Percent	Value	Percent	Value	Percent
Human Labour	8182	29.17	7331	26.39	7851	28.13
Machine use						
Hired Machine Charges*	1470	5.24	1531	5.51	1521	5.45
Use of diesel						
Owned	6668	23.77	7233	26.04	6848	24.54
Hired	1447	5.16	1282	4.61	1336	4.79
Total	8115	28.93	8514	30.65	8184	29.32
Seed & seed treatment	2217	7.90	2031	7.31	2196	7.87
Manure & Fertilizers	3350	11.95	3688	13.27	3514	12.59
Weedicides	230	0.82	388	1.39	321	1.15
Insecticides	4000	14.26	3819	13.75	3839	13.76
Interest @ 7% for half the period of crop	482	1.72	478	1.72	480	1.72
Total variable cost	28045	100.00	27779	100.00	27907	100.00
Gross returns	43642		45647		44229	
ROVC	15597		17868		16322	
Benefit-cost ratio	1.56		1.64		1.58	

*** Except diesel**

3.3 Sources and frequency of diesel purchase

3.3.1 Sources of diesel purchase

The sources of diesel purchase and distance of petrol pump from the farmers house have been given in Table 3.3.1. A perusal of the table reveals that about 95 per cent of the respondent farmers purchased diesel from the private petrol pumps and about five per cent from co-operative society. The category-wise distribution shows that all the marginal farmers, nearly 98 per cent of the small and semi-medium, about 91 per cent of the medium category and 90 per cent of the large farmers purchased diesel from private petrol pumps. As far as distance of the petrol pump from the farmer's house is concerned, about 95 per cent of the respondents reported location of the petrol pump with-in 5 Km. and about four per cent with-in 10 Km and just one per cent beyond 10 Km. of their house.

Table 3.3.1: Source of diesel purchase and distance of petrol pump from farmer's house, Punjab, 2012-13

Number

Source of diesel purchase	Marginal	Small	Semi- medium	Medium	Large	Overall
Co-operative society	-	1 (1.89)	1 (1.82)	5 (8.77)	6 (10.00)	13 (4.91)
Private petrol pump	40 (100.00)	52 (98.11)	54 (98.18)	52 (91.23)	54 (90.00)	252 (95.09)
Distance of petrol pump from house:						
i)With-in the village	-	-	-	-	-	-
ii)With-in 5Km.	39 (97.50)	52 (98.11)	52 (94.55)	53 (92.98)	58 (96.67)	254 (95.55)
iii) With-in 10Km.	1 (2.50)	1 (1.89)	3 (5.45	3 (5.26)	2 (3.33)	10 (3.77)
iv) Beyond 10Km.	-	-	-	1 (1.75)	-	1 (0.38)

Figures in parentheses are percentages of total

3.3.2 Frequency and quantity of diesel purchase

The frequency and one-time quantity of diesel purchase have been given in Table 3.3.2. It is quite obvious from the table that frequency of diesel purchase by about 61per cent of the respondents was seasonal while 39 per cent purchased diesel on monthly basis. Mostly, marginal (92.50%) and small (58.49%) farmers purchased diesel on monthly basis while medium (96.49%), semi-medium (72.73%) and large (70%) farmers purchased on seasonal basis. One time diesel purchase by 50.57 per cent of the respondents was 50 litres while 8.68 per cent purchased 100 litres to 150 litres, 28.30 per cent 200 litres and 12.45 per cent

purchased diesel more than 200 litres at one time. Mostly marginal (95%) small (84.91%) and semi-medium (50.91%) farmers purchased 50 litres diesel at one time while medium (64.91%) and large (73.33%) category farmers purchased 200 litres or more than that at one time depending upon their requirement.

Table 3.3.2: Frequency and one-time quantity of diesel purchase on the sample farms, Punjab, 2012-13

Number

Frequency of diesel purchase	Marginal	Small	Semi- medium	Medium	Large	Overall
Monthly	37 (92.50)	31 (58.49)	15 (27.27)	2 (3.51)	18 (30.00)	103 (38.77)
Seasonal	3 (7.50)	22 (41.51)	40 (72.73)	55 (96.49)	42 (70.00)	162 (61.13)
Quantity of diesel purchase (one-time):						
i)50 litres	38 (95.00)	45 (84.91)	28 (50.91)	12 (21.05)	11 (18.33)	134 (50.57)
ii)100 litres.	-	2 (2.77)	8 (14.55)	7 (12.28)	5 (8.33)	22 (8.30)
iii) 150 litres.	-	-	-	1 (1.75)	-	1 (0.38)
iv) 200 litres	-	3 (5.66)	16 (29.09)	30 (52.63)	26 (43.33)	75 (28.30)
v) > 200 litres	2 (5.00)	3 (5.66)	3 (5.45)	7 (12.28)	18 (30.00)	33 (12.45)

Figures in parentheses are percentages of total

3.4 Diesel and power subsidy withdrawal impact

This section deals with the impact of withdrawal of diesel as well as power subsidy to the agricultural sector in the Punjab state. Simulations using changing diesel prices have been undertaken to see the resultant change in the cost of cultivation/ production of various crops while keeping change in prices of other inputs and output level at the same level (cetris paribus). Also, **diesel price hike coefficient (Δ cost of production/Δ diesel price)** has been worked out to see the likely impact of minor change in the diesel price on cost of production.

3.4.1 Paddy

The changing diesel prices and its impact on cost of production of paddy have been shown in Table 3.4.1. A perusal of the table reveals the impact of hike in diesel price as on 1st June, 2014 and with zero diesel subsidy on this date. This increase in diesel price resulted in pushing up cost of cultivation as well as cost of production of paddy. In an overall scenario, the cost of production of paddy was Rs. 494 per quintal at I (base) level (1st February, 2013) which increased to Rs. 517 per quintal at II (current) level (1st June, 2014) and to Rs. 528 III (proposed) level (Zero subsidy), respectively. The diesel price hike coefficient was worked out at 2.53 showing that with one rupee increase in diesel price, the cost of production of paddy increased by 2.53 rupees. The farm category-wise analysis revealed that the impact of diesel price hike was more on large (2.97), semi-medium (2.64) and medium (2.48) farms as compared to marginal (2.29) and small (2.36) farm categories.

3.4.2 Basmati

Table 3.4.2 shows the changing diesel prices and its impact on cost of production of basmati on the sample farms. A perusal of the table reveals that with hike in diesel price, the cost of cultivation/ production of basmati increased showing the impact of hike in diesel price as on 1st June, 2014 as well as with zero diesel subsidy. In overall, the cost of production of basmati was Rs. 890 per quintal at I (base) level (1st February, 2013) which increased to Rs. 921 at II (current) level (1st June, 2014) and further Rs.936 at III (proposed) level (Zero subsidy). The diesel price hike coefficient was worked out to be 3.36 showing that with one rupee increase in diesel price, the cost of production of basmati increased by 3.36 rupees. The farm category wise analysis revealed that the impact of diesel price hike was more on marginal (3.56), semi-medium (3.30) and small (3.20) farms as compared to large (2.93) and medium (2.87) farm categories.

Table 3.4.1: Changing diesel prices and its impact on (Simulations- cetris paribus) cost of production of paddy in Punjab, 2012-13 (Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	25328	24154	23249	25158	22228	23467
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	32084	30532	31047	32629	31019	30835
	Yield (qtl/ ha)	63.47	62.32	63.42	64.58	63.49	62.47
	Cost of production (Rs/ qtl)	505	490	490	505	489	494
	Gross returns	82384	80580	81748	82662	81267	80461
	ROVC	50300	50048	50701	50033	50248	49626
II (Current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	33440	32381	32610	34126	32784	32313
	Yield (qtl/ ha)	63.47	62.32	63.42	64.58	63.49	62.47
	Cost of production (Rs/ qtl)	527	520	514	528	516	517
	Gross returns	82384	80580	81748	82662	81267	80461
	ROVC	48944	48199	49138	48536	48483	48148
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	34080	33030	33349	34834	33617	33011
	Yield(qtl/ ha)	63.47	62.32	63.42	64.58	63.49	62.47
	Cost of production (Rs/ qtl)	537	530	526	539	529	528
	Gross returns	82384	80580	81748	82662	81267	80461
	ROVC	48304	47550	48399	47828	47650	47450
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**2.29**	**2.36**	**2.64**	**2.48**	**2.97**	**2.53**

Table 3.4.2: Changing diesel prices and its impact on (Simulations- cetris paribus) cost of production of basmati in Punjab, 2012-13 (Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	27488	27016	26533	26222	28927	27447
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	33723	32730	32227	31600	34229	33296
	Yield (qtl/ ha)	37.66	38.38	37	39.42	38.79	37.42
	Cost of production (Rs/ qtl)	895	853	871	802	882	890
	Gross returns	95645	96792	87953	93934	91570	90194
	ROVC	61922	64062	55726	62334	57341	56898
II (Current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	34974	33877	33370	32556	35292	34468
	Yield (qtl/ ha)	37.66	38.38	37	39.42	38.79	37.42
	Cost of production (Rs/ qtl)	929	883	902	826	910	921
	Gross returns	92859	96792	71008	102293	91570	90194
	ROVC	57885	62915	37639	69737	56279	55727
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	35564	34418	33909	33056	35794	35021
	Yield(qtl/ ha)	37.66	38.38	37	39.42	38.79	37.42
	Cost of production (Rs/ qtl)	944	897	916	839	923	936
	Gross returns	92859	96792	71008	102293	91570	90194
	ROVC	57295	62374	37099	69238	55776	55173
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**3.56**	**3.20**	**3.30**	**2.87**	**2.93**	**3.36**

3.4.3 Cotton

Table 3.4.3 shows the changing diesel prices and its impact on cost of production of cotton crop on the sample farms. A perusal of the table reveals that the increase in diesel price resulted in increasing the cost of cultivation and production of cotton crop on the sample farms. In overall, the cost of production of cotton was Rs. 2859 per quintal at I (base) level (1st February, 2013) which increased to Rs. 2927 at II (current) level (1st June, 2014) due to increase in diesel price and Rs. 2959 at III (proposed) level if there was complete withdrawal of diesel subsidy. The diesel price hike coefficient was worked out at 7.31 revealing that with one rupee increase in diesel price, the resultant cost of production of cotton increased by 7.31 rupees. The impact of diesel price hike was more pronounced on the large (8.11) and medium (7.96) farms as compared to marginal (7.10), semi-medium (6.97) and small (6.50) farm categories. Thus, diesel price hike impact would be more on large and medium category farmers as compared to marginal, semi-medium and small farmers.

3.4.4 Sugarcane

The changing diesel prices and its impact on cost of production of sugarcane have been shown in Table 3.4.4. It is clear from the table that with the hike in diesel prices, the resultant cost of cultivation as well as cost of production of sugarcane also enhanced. In an overall scenario, the cost of production of sugarcane was Rs. 125 per quintal at I (base) level (1st February, 2013) which increased to Rs. 127 at II (current) level (1st June, 2014) and further enhanced to Rs. 128 per quintal at III (proposed) level of complete withdrawal of diesel subsidy. The diesel price hike coefficient was worked out at 0.24 showing that with one rupee increase in diesel price, the cost of production of sugarcane increased by 0.24 rupees. The farm category-wise analysis showed that the impact of diesel price hike in case of sugarcane crop was almost similar on marginal (0.24), small (0.23), semi-medium (0.24), medium (0.25) and large (0.23) farms categories. Thus impact of diesel prce hike would be almost similar on all farm categories.

Table 3.4.3: Changing diesel prices and its impact on (Simulations- cetris paribus) cost of production of cotton in Punjab, 2012-13 (Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	40664	41316	40376	41158	43527	41604
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	46271	46414	45806	47141	49663	47225
	Yield (qtl/ ha)	16.96	16.84	16.72	16.14	16.25	16.52
	Cost of production (Rs/ qtl)	2728	2756	2740	2921	3056	2859
	Gross returns	76320	74130	72890	72120	71472	72108
	ROVC	30049	27716	27084	24979	21809	24883
II (Current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	47398	47436	46896	48342	50894	48353
	Yield(qtl/ ha)	16.96	16.84	16.72	16.14	16.25	16.52
	Cost of production (Rs/ qtl)	2795	2817	2805	2995	3132	2927
	Gross returns	76320	74130	72890	72120	71472	72108
	ROVC	28922	26694	25994	23778	20578	23755
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	47929	47919	47410	48909	51475	48885
	Yield(qtl/ ha)	16.96	16.84	16.72	16.14	16.25	16.52
	Cost of production (Rs/ qtl)	2826	2846	2836	3030	3168	2959
	Gross returns	76320	74130	72890	72120	71472	72108
	ROVC	28391	26211	25480	23211	19997	23223
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**7.10**	**6.50**	**6.97**	**7.96**	**8.11**	**7.31**

Table 3.4.4: Changing diesel prices and its impact on (Simulations- cetris paribus) cost of production of sugarcane in Punjab, 2012-13 (Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	89503	90731	90480	95378	94399	94758
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	98842	99975	99898	105303	103723	104012
	Yield (qtl/ ha)	820.83	850.5	840.27	859.04	858.13	832.29
	Cost of production (Rs/ qtl)	120	118	119	123	121	125
	Gross returns	211624	218750	215823	221019	220603	214270
	ROVC	112782	118775	115925	115716	116880	110258
II (current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	100714	101828	101787	107294	105594	105869
	Yield (qtl/ ha)	820.83	850.5	840.27	859.04	858.13	832.29
	Cost of production (Rs/ qtl)	123	120	121	125	123	127
	Gross returns	211624	218750	215823	221019	220603	214270
	ROVC	110910	116922	114036	113725	115009	108401
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	101599	102703	102679	108234	106477	106745
	Yield(qtl/ ha)	820.83	850.5	840.27	859.04	858.13	832.29
	Cost of production (Rs/ qtl)	124	121	122	126	124	128
	Gross returns	211624	218750	215823	221019	220603	214270
	ROVC	110025	116047	113144	112785	114126	107525
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**0.24**	**0.23**	**0.24**	**0.25**	**0.23**	**0.24**

3.4.5 Maize

Table 3.4.5 reveals the changing diesel prices and its impact on cost of production of maize on the sample farms. A perusal of the table reveals that with hike in diesel price, the cost of cultivation/ production of maize increased showing the impact of hike in diesel price on this crop. In overall scenario, the cost of production of maize was Rs. 714 per quintal at I (base) level (1st February, 2013) which increased to Rs. 742 at II (current) level (1st June, 2014) and further Rs.756 at III (proposed) level with total abolition of diesel subsidy. The diesel price hike coefficient for maize crop was worked out to be 3.03 showing that with one rupee increase in diesel price, the cost of production of maize increased by 3.03 rupees. The farm category-wise analysis showed that the impact of diesel price hike in case of maize crop was more on small (3.41), medium (3.47) and large (3.06) farms as compared to semi-medium (2.66) and marginal (2.20) farm categories.

3.4.6 Wheat

The impact of changing diesel prices on cost of production of wheat on the sample farms have been shown on Table 3.4.6. It is quite obvious from the table that with hike in diesel price, the cost of cultivation/ production of wheat increased. The cost of production of wheat in overall was Rs. 572 per quintal at I (base) level (1st February, 2013) which increased to Rs. 603 at II (current) level (1st June, 2014) and further Rs.618 at III (proposed) level with no diesel subsidy. The diesel price hike coefficient for wheat crop was worked out at 3.29 showing that with one rupee increase in diesel price, the cost of production of wheat would increase by 3.29 rupees. The farm category-wise analysis showed that the impact of diesel price hike in case of wheat crop was more on semi-medium (3.30), large (3.24) and medium (3.19) farms as compared to marginal (3.05) and small (3.07) farm categories.

3.4.7 Sunflower

Table 3.4.7 shows the impact of changing diesel prices on cost of production of sunflower crop. It is quite obvious from the table that with hike in diesel price, have direct impact on cost of cultivation/ production of sunflower crop. The cost of production of sunflower was Rs. 1631 per quintal at I (base) level (1st February, 2013) which increased to Rs. 1729 at II (current) level (1st June, 2014) and further Rs.1775 at III (proposed) level with no diesel subsidy. The diesel price hike coefficient was 10.45 in overall scenario while on medium farms it was 10.53 and 10.45 on large farm category.

Table 3.4.5: Changing diesel prices and its impact on (Simulations- cetris paribus) cost of production of maize in Punjab, 2012-13

(Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	25960	22558	23300	26023	22644	24255
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	30799	29144	28700	32606	28467	30217
	Yield (qtl/ ha)	42.5	41.5	43.63	40.79	40.83	42.32
	Cost of production (Rs/ qtl)	725	702	658	799	697	714
	Gross returns	51986	50373	52570	48978	49028	51237
	ROVC	21187	21229	23870	16372	20561	21020
II (current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	31199	30467	29783	33926	29635	31413
	Yield(qtl/ ha)	42.5	41.5	43.63	40.79	40.83	42.32
	Cost of production (Rs/ qtl)	734	734	683	832	726	742
	Gross returns	51986	50373	52570	48978	49028	51237
	ROVC	20787	19906	22787	15052	19393	19824
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	31612	31090	30294	34549	30187	31978
	Yield(qtl/ ha)	42.5	41.5	43.63	40.79	40.83	42.32
	Cost of production (Rs/ qtl)	744	749	694	847	739	756
	Gross returns	51986	50373	52570	48978	49028	51237
	ROVC	20374	19283	22276	14429	18841	19259
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**2.20**	**3.41**	**2.66**	**3.47**	**3.06**	**3.03**

Table 3.4.6: Changing diesel prices and its impact on (Simulations-cetris paribus) cost of production of wheat in Punjab, 2012-13 (Rs./ ha)

Particulars		Marginal	Small	Semi-medium	Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	20779	19037	18080	18030	17711	18713
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	26909	25438	25071	24538	24599	25542
	Yield (qtl/ ha)	43.17	44.81	45.5	43.76	45.71	44.62
	Cost of production (Rs/ qtl)	623	568	551	561	538	572
	Gross returns	62331	64919	65344	62331	64919	65344
	ROVC	35422	39481	40273	37793	40320	39802
II (current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	28140	26723	26472	25842	25980	26912
	Yield(qtl/ ha)	43.17	44.81	45.5	43.76	45.71	44.62
	Cost of production (Rs/ qtl)	652	596	582	591	568	603
	Gross returns	62331	64919	65344	62331	64919	65344
	ROVC	34191	38196	38872	36489	38939	38432
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	28721	27329	27134	26458	26633	27559
	Yield(qtl/ ha)	43.17	44.81	45.5	43.76	45.71	44.62
	Cost of production (Rs/ qtl)	665	610	596	605	583	618
	Gross returns	62331	64919	65344	62331	64919	65344
	ROVC	33610	37590	38210	35873	38286	37785
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**3.05**	**3.07**	**3.30**	**3.19**	**3.24**	**3.29**

Table 3.4.7: Changing diesel prices and its impact on (Simulations-cetris paribus) cost of production of sunflower in Punjab, 2012-13 (Rs./ ha)

Particulars		Medium	Large	Overall
I (Base) 1st Feb, 2013	Cost of cultivation (Excluding diesel)	19789	19117	19579
	Cost of cultivation (Including diesel @ Rs.46.57 per litre)	28045	27779	27907
	Yield (qtl/ ha)	16.85	17.81	17.11
	Cost of production (Rs/ qtl)	1664	1560	1631
	Gross returns	43642	45647	44229
	ROVC	15597	17868	16322
II (current) 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 55.91 per litre)	29714	29518	29576
	Yield(qtl/ ha)	16.85	17.81	17.11
	Cost of production (Rs/ qtl)	1763	1657	1729
	Gross returns	43642	45647	44229
	ROVC	13928	16129	14653
III(Proposed) Zero subsidy On 1st June, 2014	Cost of cultivation (Including diesel @ Rs. 60.32 per litre)	30497	30338	30364
	Yield(qtl/ ha)	16.85	17.81	17.11
	Cost of production (Rs/ qtl)	1810	1703	1775
	Gross returns	43642	45647	44229
	ROVC	13145	15309	13865
Diesel price hike coefficient (Δ cost of production/Δ diesel price)		**10.53**	**10.45**	**10.45**

3.5 Impact of diesel and power subsidy withdrawal:

The impact of withdrawal of subsidies on diesel, power individually and in aggregate has been given in Table 3.4.8, 3.4.9 and 3.4.10. A perusal of Table 3.4.8 revealed that due to withdrawal of diesel subsidy, the cost of production of sunflower increased by 8.81 per cent followed by 7.90 per cent in case of wheat, 7.06 per cent in paddy, 5.83 per cent in maize, 5.18 per cent in basmati, 3.52 per cent in cotton and 2.63 per cent in sugarcane. The increase in cost of production of different crops according to various farm size categories due to withdrawal of diesel subsidy did not show any specific trend of increase or decline. However, there was significant impact of withdrawal of diesel subsidy in terms of increased cost of production of different crops as well as under various farm categories.

The electricity supply to farm sector in Punjab is free. The impact of withdrawal of power subsidy was envisaged to see its impact on cost of production of different crops. Table 3.4.9 reveals the impact of power subsidy withdrawal on important crops in Punjab. The major impact of power subsidy withdrawal was seen on increase in cost of production of paddy (25.30%) due to more number of irrigations applied to this crop followed by Basmati (21.24%), sunflower (9.07%), wheat (6.64%), maize (3.50%), sugarcane (2.63%) and cotton (1.75%). The impact of power subsidy withdrawal was more on semi-medium, medium and large farm categories as compared to marginal and small farms.

The impact of diesel and power subsidy withdrawal on cost of production of major crops in Punjab has been given in Table 3.4.10. A perusal of the table reveals that the cost of production of paddy increase by 32.35 per cent due to withdrawal of both diesel and power subsidy. The increase in cost of production of basmati was 26.42 per cent followed by sunflower (17.88%), wheat (14.55%), maize (9.33%), sugarcane (5.97%) and cotton (5.26%). The farm category-wise analysis revealed that increase in cost of production of major crops was more pronounced on semi-medium, medium and large categories as compared to marginal and small farms. Thus, the impact of power and diesel subsidy withdrawal would be more on large and medium farmers as compared to marginal and small farmers.

Table 3.4.8: Impact of diesel subsidy withdrawal on cost of production, important crops, Punjab, 2012-13 (Rs/qtl)

Crops	Marginal	Small	Semi medium	Medium	Large	Overall	Marginal	Small	Semi medium	Medium	Large	Overall
	With subsidy						Without subsidy					
Paddy	505	490	490	505	489	494	537 (6.22)	530 (8.18)	526 (7.41)	539 (6.76)	529 (8.37)	528 (7.06)*
Basmati	895	853	871	802	882	890	944 (5.46)	897 (5.16)	916 (5.22)	839 (4.61)	923 (4.57)	936 (5.18)
Cotton	2728	2756	2740	2921	3056	2859	2826 (3.58)	2846 (3.24)	2836 (3.50)	3030 (3.75)	3168 (3.65)	2959 (3.52)
Sugarcane	120	118	119	123	121	125	124 (2.79)	121 (2.73)	122 (2.78)	126 (2.78)	124 (2.65)	128 (2.63)
Maize	725	702	658	799	697	714	744 (2.64)	749 (6.68)	694 (5.55)	847 (5.96)	739 (6.04)	756 (5.83)
Wheat	623	568	551	561	538	572	665 (6.73)	610 (7.43)	596 (8.23)	605 (7.83)	583 (8.27)	618 (7.90)
Sunflower	-	-	-	1664	1560	1631	-	-	-	1810 (8.74)	1703 (9.21)	1775 (8.81)

*Figures in parentheses indicate per cent increase in cost of production due to withdrawal of diesel subsidy

Table 3.4.9: Impact of power subsidy withdrawal on cost of production, important crops, Punjab, 2012-13 (Rs/qtl)

Crops	Marginal	Small	Semi medium	Medium	Large	Overall	Marginal	Small	Semi medium	Medium	Large	Overall
	With subsidy						Without subsidy					
Paddy	505	490	490	505	489	494	606 (20.00)	606 (23.67)	618 (26.12)	630 (24.75)	618 (26.38)	619* (25.30)
Basmati	895	853	871	802	882	890	1032 (15.31)	1034 (21.22)	1074 (23.31)	1001 (24.81)	1097 (24.38)	1079 (21.24)
Cotton	2728	2756	2740	2921	3056	2859	2765 (1.36)	2804 (1.74)	2790 (1.82)	2973 (1.78)	3115 (1.93)	2909 (1.75)
Sugarcane	120	118	119	123	121	125	124 (3.33)	122 (3.39)	124 (4.20)	128 (4.07)	126 (4.13)	126 (3.28)
Maize	725	702	658	799	697	714	744 (2.62)	724 (3.13)	684 (3.95)	824 (3.13)	728 (4.45)	739 (3.50)
Wheat	623	568	551	561	538	572	655 (5.14)	604 (6.34)	588 (6.72)	601 (7.13)	577 (7.25)	610 (6.64)
Sunflower	-	-	-	1664	1560	1631	-	-	-	1818 (9.25)	1708 (9.49)	1779 (9.07)

*Figures in parentheses indicate per cent increase in cost of production due to withdrawal of power subsidy

Table 3.4.10: Impact of diesel & power subsidy withdrawal on cost of production, important crops, Punjab, 2012-13 (Rs/qtl)

Crops	Marginal	Small	Semi medium	Medium	Large	Overall	Marginal	Small	Semi medium	Medium	Large	Overall
	With diesel and power subsidy						Without diesel and power subsidy					
Paddy	505	490	490	505	489	494	637 (26.23)	646 (31.85)	654 (33.53)	664 (31.51)	659 (34.75)	654 (32.35)*
Basmati	895	853	871	802	882	890	1081 (20.77)	1078 (26.38)	1119 (28.53)	1038 (29.42)	1137 (28.95)	1125 (26.42)
Cotton	2728	2756	2740	2921	3056	2859	2863 (4.94)	2893 (4.98)	2886 (5.33)	3083 (5.53)	3226 (5.58)	3009 (5.26)
Sugarcane	120	118	119	123	121	125	127 (6.13)	125 (6.11)	127 (6.98)	131 (6.84)	129 (6.78)	129 (5.97)
Maize	725	702	658	799	697	714	763 (5.26)	771 (9.82)	721 (9.50)	872 (9.09)	770 (10.49)	781 (9.33)
Wheat	623	568	551	561	538	572	697 (11.87)	646 (13.77)	633 (14.94)	645 (14.95)	621 (15.52)	655 (14.55)
Sunflower	-	-	-	1664	1560	1631	-	-	-	1964 (18.00)	1852 (18.70)	1923 (17.88)

*Figures in parentheses indicate per cent increase in cost of production due to withdrawal of diesel and power subsidy

3.6 Conclusions & policy implications

The above discussion brings us to the conclusion regarding change in cost of cultivation/ production of important crops in Punjab worked out after taking in to account the withdrawal of diesel and power subsidies and bringing out specific policy implications affecting the state agriculture due to withdrawal of diesel and power subsidy. It was found out from simulations regarding change in diesel prices keeping prices of all other inputs at constant level (cetris-paribus) the cost of production of paddy increased by 7.06 per cent with the withdrawal of diesel subsidy. Similarly, the increase in cost of production of basmati was 5.18 per cent; while in other crops it was 3.52 per cent in cotton, 2.63 per cent in sugarcane, 5.83 per cent in maize, 7.90 per cent in wheat and 8.81 per cent in sunflower. The diesel price hike coefficient showed that with one rupee increase in diesel price, the resultant cost of production of paddy increased by Rs.2.53; while in other crops such as basmati, increase in cost of production was by Rs. 3.36, in cotton by Rs.7.31, in sugarcane by Rs. 0.24, in maize by Rs. 3.03, in wheat by Rs.3.29 and in case of sunflower by Rs. 10.45. The increase in cost of production of different crops under various farm categories due to withdrawal of diesel subsidy did not show any specific trend of increase or decline according to size of the farm category. The major impact of power subsidy withdrawal was seen on increase in cost of production of paddy (25.30%) due to more number of irrigations applied to this crop followed by Basmati (21.24%), sunflower (9.07%), wheat (6.64%), maize (3.50%), sugarcane (3.28%) and cotton (1.75%). The impact of power subsidy withdrawal was more on semi-medium, medium and large farm categories as compared to marginal and small farms. In aggregate the cost of production of paddy increased by 32.35 per cent due to withdrawal of both diesel and power subsidy. Similarly, the increase in cost of production of basmati was by 25.42 per cent followed by sunflower (17.88%), wheat (14.55%), maize (9.33%), sugarcane (5.97%) and cotton (5.26%). The farm category-wise analysis showed that the impact of power and diesel subsidy withdrawal would be more on large and medium farmers as compared to marginal and small farmers.

The major policy issues drawn from the discussion is that Punjab government should emphasize the union government to increase the minimum support price of paddy and wheat, which are the crops for which state farmers get assured price, in commensurate with the diesel price hike coefficient. For other crops also, MSP should be enhanced in proportion to the diesel price hike coefficient, for which MSP is announced but is not actually implemented. In case, power subsidy is withdrawn by the state government, farmers

especially marginal and small one's should be compensated according to the electricity usage bill generated for irrigating various crops on their farms. Thus, for keeping marginal and small farmers in farming business, subsidies especially power subsidy should not be withdrawn, however, their form can be changed for the benefit of these farmers in general and farming community in particular.

CHAPTER-IV

SUMMARY

The diesel retail prices continue to be regulated by the government of India since early 1970's and hence contributed in a major way towards the build up of fuel subsidies over the years. Government of India has recently taken a number of measures to reform its fuel subsidy system. In June 2010, petrol pricing was liberalized and the intention to liberalize diesel prices announced. In its 2012-13 budget speech, the government stated its intention to limit all central subsidies (including those on fuels) to less than 2 percent of GDP in 2012-13, and reducing them to less than 1.75 percent of GDP over three years. In January 2013, the government announced that Oil Marketing Companies (OMCs) would have greater flexibility in setting diesel prices and that bulk users of diesel would pay unsubsidized prices. (IMF, 2013).

Oil Marketing Companies (OMCs) are increasing per litre diesel prices by Rs. 0.5 per month from January, 2013 onwards with some exceptions. Since then, the diesel prices had risen by a cumulative Rs 10.12 per litre in 16 instalments and the diesel subsidy is likely to be completely removed with automatic deregulation of fuel in next few months if the rupee continue to strengthen and monthly price hikes continue (Daily Post, 2014,). Therefore, there is a need to assess the likely impact of recent energy price policy changes on the Indian agriculture. Punjab agriculture, being on forefront in terms of diesel/energy consumption may hit hard due to these diesel oil policy changes resulting into the increase of cost of agricultural production. Keeping this in view, the present study has been undertaken to estimate the use of diesel in crop production and analyse the likely impact of diesel/energy price policy on the cost-profitability relationship of major crops in Punjab. The study was undertaken with the objectives, to study the status of electricity and diesel use for various crop-production-activities in the state and to examine the impact of squeezing diesel subsidy/enhancing diesel price on the cost of agricultural production and profitability.

To meet the specific objectives of the study, at first stage of sampling six districts namely Hoshiarpur, Amritsar, Jalandhar, Ludhiana, Bathinda and Fazilika represented all the major agro-climatic regions of the state were selected purposively. From each of the selected district, two blocks were selected randomly. Thus, overall twelve blocks from the sample districts were selected. From each selected block a cluster of villages was selected randomly for the farm household survey. Finally from each of the selected village cluster, 25 cultivators

comprising 5 cultivators representing each of different categories as per standard national level definition of operational holdings were selected randomly. Thus, overall from the state, total sample of 300 farmer households comprising 60 farmers each of marginal, small, semi-medium, medium and large categories forms the basis for the present enquiry. To work out the components of cost of cultivation of selected crops, data on various aspects of fixed and variable costs were collected on an especially prepared schedule for important crops in Punjab. Simple tabular analysis was conducted to analyse the results. Simulations by changing diesel prices were undertaken to work out the cost of production/ cultivation of various crops by keeping prices of all other inputs at constant level as at the time of data collection and just varying diesel prices only in order to see the impact of diesel subsidy withdrawal on cost of production of crops and also worked out 'diesel price hike coefficient'. Similarly, the impact of power subsidy withdrawal on cost of production of major crops in Punjab was also investigated by calculating the cost of the electricity consumed for irrigating various crops and adding it to the total variable cost.

The socio-economic characters of the sample respondents revealed that there were about 40 per cent adult males in the families of respondent farmers followed by about 35 per cent adult females and 25 per cent minors. The farm category-wise analysis revealed that relative proportion of adult males as compared to adult females was more among marginal, small and semi-medium categories as compared other farm categories. About 38 per cent of the family heads among sample households were more than 50 years old while about 35 per cent were aged between 36-50 years and remaining 27 per cent were quite young and aged up to 35 years. As far as education level of the respondents was concerned, nearly fifty per cent of the respondents were educated up to matric level followed by secondary, primary, graduation and post- graduation level.

The operational holding size per farm was 5.62 hectares with land owned being 3.61 hectares; land leased-in 2.13 hectares and land leased-out 0.12 hectares. The whole area under cultivation was irrigated with average rental value of land leased-in being Rs. 68,180 and that of land leased-out being Rs. 71,430 per hectare. Electric motor, submersible pump, diesel engine, generator and canals were the various sources of irrigation on the sample farms. The number of submersible pumps per farm in an overall scenario were highest (0.76) followed by generator (0.27) electric motor (0.23) and diesel engine (0.17). The total income from farming, dairy farming, service, business and other sources was Rs.8,01,364 per farm. The relative share of farming in the total income was 99.20 per cent followed by minor share from

dairy farming, service sector, business and other sources. The category-wise analysis reveals that the relative share of farming in total income was lowest on marginal farms and highest on the large farms.

The average number of tractors per farm was 0.79 with 43.94 H.P. and present value being Rs.1,94,106. The category-wise analysis reveals that the numbers of tractors per farm were more on large farms as compared to other farm categories and all the respondents on medium and large farms owned at least one tractor The average number of tractor drawn implements was 5.70 on large, 4.20 on medium, 3.70 on semi-medium, 1.32 on small, 0.18 on marginal and 2.89 in an overall scenario. Therefore, the present value of tractor drawn implements was more on large farms due to their higher number as compared to other farm categories.

Cropping pattern and cropping intensity on the sample farms revealed that during *kharif season* paddy was the major crop occupying 2.32 hectares (18.83% of gross cropped area) of the operational holding in overall scenario followed by Bt cotton, basmati, sugarcane, maize, guara, fodder and vegetables. During *rabi season* wheat was the major crop sown on 4.58 hectares (37.20 % of the gross cropped area) in overall scenario followed by fodder, potato and other minor crops. The crops sown during *zaid season* were; potato, sunflower, spring maize, vegetables and mentha. The percentage share of *zaid season* crops was 8.51 per cent of the gross cropped area on the sample farms. The cropping intensity was 219.24 per cent in an overall scenario with highest on large farms (222.81%) and lowest on marginal (206.84%) farms.

The cost-return structure of paddy cultivation revealed that human labour use per hectare of paddy cultivation worked out to be 313.85 hours in an overall scenario while category-wise analysis revealed that highest number of human labour hours were spent on medium farms followed by marginal farms which were lowest. In case of machine labour (tractor), overall 13.14 hours were utilized in various field operations while combine harvesting hours for paddy crop were 1.77 per hectare. The irrigation hours using electric motor/ submersible pump were 255.97 per hectare. Diesel engine use in irrigating paddy crop was more on marginal farms while generator use was more on large farms. Similarly, diesel consumption per hectare on owned and hired machinery taken together was 155.50 litres in paddy cultivation. The proportionate share of diesel consumption in total variable cost was 23.49 per cent in an overall scenario while its share was lowest on small farms and highest on large

farms. The returns over variable cost (ROVC) in paddy cultivation were about Rs.49627 in an overall scenario being highest (Rs. 50702) on semi-medium farms and lowest (Rs. 50034) on medium farms.

In case of basmati crop, 462.47 human labour hours were spent on various farm related operations per hectare while these were highest on small farms and lowest on medium farms category. The tractor use on sample farms was estimated at 16.22 hours per hectare while combine harvester use was 0.97 hours. The total irrigation hours using electric motor/ submersible pump in basmati cultivation were 230.83 hours per hectare. Diesel engine and generator hours utilized for irrigating basmati crop were estimated at 34.37 hours and 0.84 hours, respectively. The diesel consumption per hectare including owned and hired machinery was 123.41 litres in overall scenario. The category-wise analysis revealed that diesel consumption per hectare was highest on marginal (131.59 ltrs.) farms and lowest on medium (111.34 ltrs.) farms. The relative share of diesel consumption in total variable cost was found to be 17.26 per cent. The returns over variable cost (ROVC) in basmati cultivation were about Rs.56898 in an overall situation while it being highest (Rs.64061) on small farms and lowest (Rs.55725) on semi-medium farms.

In case of cotton crop, 547.95 human labour hours were utilized while raising this crop while according to farm category, highest number of labour hours were spent on large farms and lowest on the marginal farms. The tractor use was 25.15 hours per hectare for various farm operations in cotton cultivation. The irrigation hours estimated on the use of electric motor/ submersible pump were 27.03 hours while the total diesel consumption on the sample farms in overall scenario was 118.64 litres. The relative share of diesel use was 11.70 per cent of total variable cost constituting 8.99 per cent from owned sources and 2.71 per cent from hired one's. The returns over variable cost (ROVC) from cotton cultivation were Rs. 24883 per hectare with highest (Rs.30048) on marginal farms and lowest (Rs.21809) on large farms.

In case of sugarcane crop, 1122.92 human labour hours per hectare were spent on various cultivation related operations in an overall situation. The tractor hours spent on various farm operations were 22.23 per hectare. For irrigating sugarcane crop, 138.06 hours were spent while using electric motor/ submersible pump. Also, 192 litres of diesel was consumed per hectare in sugarcane cultivation with more on medium farms and less on small farms. The relative share of diesel use in total variable cost was found to be 8.60 per cent with 7.91 per cent from owned sources and 0.69 per cent from hired machinery. The returns over variable

cost (ROVC) were Rs.110258 per hectare in sugarcane cultivation being Rs.118775 on small farms, which were highest among farm categories and Rs. 112783 on marginal farms, which were lowest.

In case of maize crop, 311.84 human labour hours were used while raising the crop on the sample farms. The tractor use for various farm related operations was 11.19 hours while combine harvester use was 1.29 hours in maize cultivation. The irrigation hours estimated on the use of electric motor/ submersible pump were 33.88 hours. The total diesel consumption was 125.83 litres in maize cultivation constituting 94.41 litres from owned sources and 31.42 litres from hired machinery. The relative share of diesel use was 19.39 per cent of total variable cost in overall scenario. The returns over variable cost (ROVC) were Rs.21019 per hectare from maize cultivation while farm category-wise analysis showed that returns were highest (Rs.23869) on semi-medium farm category and lowest (Rs.16372) on medium farms.

In wheat crop, 124.53 human labour hours per hectare were utilized to raise this crop on the sample farms. The tractor use was 20.13 hours for undertaking various field operations while for harvesting, by using combine harvester, 2.33 hours per hectare were spent. The irrigation hours worked out on the basis of electric motor/ submersible pump use were 54.14 hours in an overall scenario. The total diesel consumption in wheat crop on the sample farms was 144.13 litres. The relative share of diesel use in total variable cost was 26.28 per cent with 13.70 per cent share from owned machinery and 12.58 per cent from hired machine use. In overall scenario, the returns over variable cost (ROVC) were Rs.39806 per hectare in wheat cultivation and about Rs.40330 on large farms which were highest among farm categories and Rs. 35422 on marginal farms which were lowest.

In overall, 218.48 human labour hours were estimated to be used per hectare in sunflower cultivation on the sample farms. The tractor use in various farm operations worked out to be 18.95 hours. Also, combine harvester was used to harvest sunflower crop and 2.5 hours per hectare were spent on this particular operation. For irrigating sunflower crop, electric motor and submersible pumps were used and in overall, 82.36 hours were spent in irrigating one hectare of sunflower crop. The total consumption of diesel for various farm operations in sunflower crop was estimated at 175.73 litres. The share of diesel use in total variable cost in sunflower cultivation was 29.32 per cent. The returns over variable cost (ROVC) in sunflower cultivation worked out to be Rs.16322 per hectare while on medium farms the returns were Rs.15597 and Rs.17868 per hectare on large farms.

The source of diesel purchase showed that about 95 per cent of the respondent farmers purchased diesel from the private petrol pumps and about five per cent from co-operative societies. The distance of the petrol pump from the farmer's house was with-in 5 Km as reported by 95 per cent of the respondents. Mostly farmers purchased diesel seasonally (61.13%) and one time purchase of diesel was about 50 litres as reported by about fifty per cent of the respondents.

The changing diesel prices and its impact on cost of production of paddy, basmati, cotton, sugarcane, maize, wheat and sunflower was seen at I (base) level (1st February, 2013), secondly at II (current) level (1st June, 2014) and thirdly at III (proposed) level with zero diesel subsidy. The cost of production of paddy increased from Rs. 494 per quintal at I level to Rs. 517 and Rs. 528 per quintal at II and III level, respectively. The diesel price hike coefficient was worked out at 2.53 showing that with one rupee increase in diesel price, the cost of production of paddy increased by 2.53 rupees. In basmati crop, cost of production increased from Rs. 890 per quintal at I level to Rs. 921 at II and further Rs.936 at III level and the diesel price hike coefficient was worked out at 3.36. In cotton crop, the cost of production was estimated at Rs. 2859 per quintal at I level which increased to Rs. 2967 at II level and Rs.2959 at III level if there was complete withdrawal of diesel subsidy. The diesel price hike coefficient was worked out at 7.31 in cotton crop. The cost of production of sugarcane worked out to be Rs. 125 per quintal at I level which increased to Rs. 127 at II level and further to Rs. 128 per quintal at III level. The diesel price hike coefficient was estimated at 0.24 showing that with one rupee increase in diesel price, the cost of production of sugarcane increased by 0.24 rupees. Similarly, the cost of production of maize was Rs. 714 at I level which increased to Rs. 742 and Rs. 756 at II and III level, respectively with the total abolition of diesel subsidy and also, diesel price hike coefficient was worked out to be 3.03 for maize crop. In case of wheat crop, the cost of production increased from Rs. 572 per quintal at I level to Rs. 603 at II level and further Rs.618 at III level. The diesel price hike coefficient for wheat crop was worked out at 3.29 showing that with one rupee increase in diesel price the cost of production of wheat increases by 3.29 rupees. Lastly, the cost of production of sunflower worked out at Rs. 1631 per quintal at I level which increased to Rs. 1729 and Rs.1775 at II and III level, respectively while the diesel price hike coefficient was worked out to be 10.45.

It was found out that due to withdrawal of diesel subsidy, the cost of production of sunflower increased by 8.81 per cent followed by 7.90 per cent in case of wheat, 7.06 per cent in paddy,

5.83 per cent in maize, 5.18 per cent in basmati, 3.52 per cent in cotton and 2.63 per cent in sugarcane. The increase in cost of production of different crops according to various farm size categories due to withdrawal of diesel subsidy did not show any specific trend of increase or decline.

The major impact of power subsidy withdrawal was seen on increase in cost of production of paddy (25.30%) due to more number of irrigations applied to this crop followed by Basmati (21.24%), sunflower (9.07%), wheat (6.64%), maize (3.50%), sugarcane (2.63%) and cotton (1.75%). The impact of power subsidy withdrawal was more on semi-medium, medium and large farm categories as compared to marginal and small farms.

Further, the impact of both diesel and power subsidy withdrawal on cost of production of major crops in Punjab revealed that the cost of production of paddy increase by 32.35 per cent due to withdrawal of both diesel and power subsidy. The increase in cost of production of basmati was 26.42 per cent followed by sunflower (17.88%), wheat (14.55%), maize (9.33%), sugarcane (5.97%) and cotton (5.26%). The farm category-wise analysis revealed that increase in cost of production of major crops was more pronounced on semi-medium, medium and large categories as compared to marginal and small farms. Thus, the impact of power and diesel subsidy withdrawal was more on large and medium farmers as compared to marginal and small farmers.

The major policy issue drawn was to increase the minimum support price of crops in commensurate with the diesel price hike coefficient. For keeping marginal and small farmers of the Punjab state in farming business, power subsidy should not be withdrawn, however, its form can be changed for the benefit of these farmers.

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Appendix-I

Cost of production (Rs/ ha) of Paddy in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	32084	30532	31047	32629	31019	30835
Yield(qtl/ha)	63.47	62.32	63.42	64.58	63.49	62.47
Cost of production(Rs /qtl)	505	490	490	505	489	494
Gross returns	82384	80580	81748	82662	81267	80461
ROVC	50300	50048	50701	50033	50248	49626
Without Electricity Subsidy						
Electricity Cost	6348	7222	8118	8072	8248	7864
Cost of cultivation (including electricity cost)	38432	37754	39165	40701	39267	38699
Yield(qtl/ha)	63.47	62.32	63.42	64.58	63.49	62.47
Cost of production(Rs /qtl)	606	606	618	630	618	619
Gross returns	82384	80580	81748	82662	81267	80461
ROVC	43952	42826	42583	41961	42000	41762

Appendix-II

Cost of production (Rs/ ha) of Basmati in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	33723	32730	32227	31600	34229	33296
Yield(qtl/ha)	37.66	38.38	37	39.42	38.79	37.42
Cost of production(Rs /qtl)	895	853	871	802	882	890
Gross returns	95645	96792	87953	93934	91570	90194
ROVC	61922	64062	55726	62334	57341	56898
Without Electricity Subsidy						
Electricity Cost	5138	6966	7522	7845	8313	7091
Cost of cultivation (including electricity cost)	38861	39696	39749	39445	42542	40387
Yield(qtl/ha)	37.66	38.38	37	39.42	38.79	37.42
Cost of production(Rs /qtl)	1032	1034	1074	1001	1097	1079
Gross returns	95645	96792	87953	93934	91570	90194
ROVC	56784	57096	48204	54489	49028	49807

Appendix-III

Cost of production (Rs/ ha) of Cotton in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	46271	46414	45806	47141	49663	47225
Yield(qtl/ha)	16.96	16.84	16.72	16.14	16.25	16.52
Cost of production(Rs /qtl)	2728	2756	2740	2921	3056	2859
Gross returns	76320	74130	72890	72120	71472	72108
ROVC	30049	27716	27084	24979	21809	24883
Without Electricity Subsidy						
Electricity Cost	616	809	848	845	952	830
Cost of cultivation (including electricity cost)	46887	47223	46654	47986	50615	48055
Yield(qtl/ha)	16.96	16.84	16.72	16.14	16.25	16.52
Cost of production(Rs /qtl)	2765	2804	2790	2973	3115	2909
Gross returns	76320	74130	72890	72120	71472	72108
ROVC	29433	26907	26236	24134	20857	24053

Appendix-IV

Cost of production (Rs/ ha) of Sugarcane in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	98842	99975	99898	105303	103723	104012
Yield(qtl/ha)	820.83	850.5	840.27	859.04	858.13	832.29
Cost of production(Rs /qtl)	120	118	119	123	121	**122**
Gross returns	211624	218750	215823	221019	220603	214270
ROVC	112782	118775	115925	115716	116880	110258
Without Electricity Subsidy						
Electricity Cost	3270	3879	4314	4311	4740	4241
Cost of cultivation (including electricity cost)	102112	103854	104212	109614	108463	108253
Yield(qtl/ha)	820.83	850.5	840.27	859.04	858.13	832.29
Cost of production(Rs /qtl)	124	122	124	128	126	**126**
Gross returns	211624	218750	215823	221019	220603	214270
ROVC	109512	114896	111611	111405	112140	106017

Appendix-V

Cost of production (Rs/ ha) of Maize in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	30799	29144	28700	32606	28467	30217
Yield(qtl/ha)	42.5	41.5	43.63	40.79	40.83	42.32
Cost of production(Rs /qtl)	725	702	658	799	697	714
Gross returns	51986	50373	52570	48978	49028	51237
ROVC	21187	21229	23870	16372	20561	21020
Without Electricity Subsidy						
Electricity Cost	817	882	1155	1015	1257	1041
Cost of cultivation (including electricity cost)	31616	30026	29855	33621	29724	31258
Yield(qtl/ha)	42.5	41.5	43.63	40.79	40.83	42.32
Cost of production(Rs /qtl)	744	724	684	824	728	739
Gross returns	51986	50373	52570	48978	49028	51237
ROVC	20370	20347	22715	15357	19304	19979

Appendix-VI

Cost of production (Rs/ ha) of Wheat in Punjab with and without power subsidy, 2012-13

Particulars	Marginal	Small	Semi medium	Medium	Large	Overall
With Electricity Subsidy						
Cost of cultivation (excluding electricity cost)	26909	25438	25071	24538	24599	25542
Yield(qtl/ha)	43.17	44.81	45.5	43.76	45.71	44.62
Cost of production(Rs /qtl)	623	568	551	561	538	572
Gross returns	62331	64919	65344	62331	64919	65344
ROVC	35422	39481	40273	37793	40320	39802
Without Electricity Subsidy						
Electricity Cost	1381	1605	1675	1748	1767	1663
Cost of cultivation (including electricity cost)	28290	27043	26746	26286	26366	27205
Yield(qtl/ha)	43.17	44.81	45.5	43.76	45.71	44.62
Cost of production(Rs /qtl)	655	604	588	601	577	610
Gross returns	62331	64919	65344	62331	64919	65344
ROVC	34041	37876	38598	36045	38553	38139

Appendix-VII

Cost of production (Rs/ ha) of Sunflower in Punjab with and without power subsidy, 2012-13

Particulars	Medium	Large	Overall
With Electricity Subsidy			
Cost of cultivation (excluding electricity cost)	28045	27779	27907
Yield(qtl/ha)	16.85	17.81	17.11
Cost of production(Rs /qtl)	1664	1560	1631
Gross returns	43642	45647	44229
ROVC	15597	17868	16322
Without Electricity Subsidy			
Electricity Cost	2595	2636	2530
Cost of cultivation (including electricity cost)	30640	30415	30437
Yield(qtl/ha)	16.85	17.81	17.11
Cost of production(Rs /qtl)	1818	1708	1779
Gross returns	43642	45647	44229
ROVC	13002	15232	13792

Annexure VIII: Peer Reviewer's Comments on the Draft Report "Impact of Diesel/ Power Subsidy withdrawal on Production Cost of Important Crops in Punjab"
submitted by AERC, Punjab Agricultural University, Ludhiana

1. Title of the draft report examined: ''Impact of Diesel/ Power Subsidy withdrawal on Production Cost of Important Crops in Punjab''
2. Date of receipt of the Draft report: 27 February 2015.
3. Date of dispatch of the comments: 30 March 2015.
4. Comments on the Objectives of the study:

   The authors have addressed all the three objectives set for the analyses.

5. Comments on Research Methodology:

   The sample size and crops included for analysis are adequate. All categories of farmers have been covered. However, Ch-1 largely focuses on diesel related issues while the study relates to diesel as well as power. Hence, there is a need to maintain a balance. In particular, issues related to power subsidy may be highlighted by citing some literature.

6. Comments on Analysis:

   The report is comprehensive and results are presented well. However, following comments are offered to strengthen the report

(i) The analysis of the impact of escalating prices of diesel on cost of production and net returns is carried out for paddy, basmati, cotton, sugarcane, maize, wheat and sunflower at three price levels of diesel called different synthetic situations by the authors.

On the other hand, impact of withdrawal of power subsidy on cost and net returns from cultivation of above mentioned crops is analysed at one level only. For maintaining uniformity in results, the impact of withdrawal of power subsidy on cost and returns may also be analysed at three levels of diesel price. At the end, a summary table providing percentage change in cost and returns after withdrawal of diesel and power subsidy should be prepared.

(ii) There are minor typing errors like bye product for by product. There is a need to make corrections.

The quality of the report is good and therefore, recommended for finalization after incorporation of above points.

Annexure IX: ACTION TAKEN ON THE PEER REVIEWER'S COMMENTS BY AERC, LUDHIANA

1. Comments on Research Methodology: Suggestion incorporated

2. Comments on the Analysis:

As far as simulations regarding changing diesel prices are concerned, these were carried out to work out 'Diesel price hike coefficient' which is one of the major issues often raised by the farmers as well as policy planners whenever there is change in diesel price.

However, power subsidy withdrawal scenario was kept separate and discussed the case with power subsidy and without power subsidy only. It's likely withdrawal impact on cost - returns from various crops has been appended (I to VII).

Impact of withdrawal of diesel and power subsidy on cost of production of major crops in totality as desired has already been summarised in Table 3.4.10.

Other suggested corrections have been incorporated.

(D.K.Grover)

AERC, Ludhiana