

AGRICULTURAL DIVERSIFICATION AND CONTRACT FARMING IN PUNJAB

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Agrarian crisis has penetrated deep into the agriculture of Punjab since 1980s after the green revolution lost its sustenance. Agricultural diversification is being recommended as the strategy to weed out the agrarian crisis. Contract Farming was adopted by the Government of Punjab as a tool to promote diversification in the state. This paper attempts to examine empirically the extent and pace of diversification using Simpson Index of Diversity and share of contract farming in the state. The study covers a period of four decades from 1970-71 to 2000-09. It also pictures out the current status of Punjab's agronomy and concludes that the Punjab's agriculture has reached a saturation point. The environmental health has become the cause of concern. Despite of many recommendations and diversification attempts, there seems to be meagre changes in agronomy. The paper suggests that concrete efforts are needed by the government and the farmers so as to bring out substantial changes in the agricultural economy of the state.

Keywords: Contract Farming, Agrarian Crisis, Green Revolution.

INTRODUCTION

Punjab's agrarian sector portrayed a strategic role in the success of green revolution in 1960s. The prolific land of Punjab contributed in augmenting the economic growth of the Indian economy (Chand 1999; Singh L and Singh S 2002). Since then, the growth rate of agriculture has shown upward trend till 1980s after which it started declining. This decelerating agricultural trend was induced by wheat-paddy monoculture, over mechanisation and intensive use of inputs. The intensive monoculture of wheat and paddy had a pernicious impact on the natural resource base of the state. Excessive use of chemical fertilizers and pesticides, decline in water table and increase in water logging, soil salinity, pollution etc. became the major problems in the state (Gill K K and Gill S S 1990). The consequences were felt in the form of stagnation in output, declining farmers' incomes, declining productivity, environmental degradation, de-peasantization and suicides by farmers (Chand 1999; Singh 2000b; Kalkat 2008; Economic Survey of Punjab 2010-11). These are the issues that have become a cause of concern and need expeditious actions. Diversification from existing wheat rice monoculture to alternative crops or linking agriculture production with agri-business activities has been suggested by several economists in the wake of aggravating agrarian crisis (Sidhu 2002; Singh L and Singh S 2002; Singh 2004). The Punjab government is persuading farmers to shift to other crops and has adopted 'shift area out of wheat and paddy' in its agriculture policy. Cited in Human Development Report Punjab (2004), "Pg 40, The state government is proposing to shift towards value-added, water light crops such as fruit and vegetables, maize, oilseeds, pulses and floriculture, and to revive allied occupations such as dairy farming, poultry, piggery, mushroom cultivation, bee keeping and others by launching a programme called 'Second Push in Punjab Agriculture and Allied Sectors'. The programme aims to create a voluntary shift in the cropping pattern, introduce income/employment-generating,

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productivity oriented programmes directly benefiting the farmers of Punjab; and safeguard the valuable and scarce resources of land, water and environment from further deterioration". It is also been recommended in Economic Survey of Punjab (2010-11) to promote diversification and raise value addition in each agro climatic region of Punjab depending on soil health. Thus, diversifying the area to alternative crops was urged as the solution but the problem does not ends here as the farmers especially small and marginal are bereft of capital, new technologies and skill. Thus, the processing and marketing activities were promoted to iron out the difficulties of farmers' and to bring dynamism to the agriculture by either reducing the cost of cultivation or by raising the productivity by value addition or diversification (Singh 2000a; Singh 2004).

Punjab Agro-Industries Corporation (henceforth, PAIC) is the premier agency of the government established in 1966 for facilitating agro-based industries and providing quality inputs like fertilizers, pesticides and tractors to farmers. In early 1980s, PAIC ventured into project development activities & establishment of agro processing units in the public sector¹. In 1988 with the support of Bhartiya Kisan Union (BKU) and Shiromani Akali Dal² (SAD), it brought in PepsiCo to procure and process certain fruits and vegetables of the state. By the early 1990s, PepsiCo got into production and processing of tomatoes. This was followed by Nijjer which also set up a processing plant for tomatoes and started procuring produce from the farmers under contracts (Singh 2000b). Thus, this system of Contract Farming (CF) is not a new concept in Punjab though it was introduced as a programme by the Punjab government in 2002-03 with the establishment of Punjab Agro Foodgrains Corporation Ltd (henceforth, PAFC) for promoting and coordinating the activities of diversification under CF. The diversification of agriculture through CF was initiated in crops like Hyola, Sunflower, Malting Barley and Maize. The prime objective of PAFC has been to reduce the area under wheat and paddy and shift to crops requiring lesser irrigation to conserve water and improve soil health. Besides, PAFC there are many indigenous and multinational companies which are doing CF directly with the farmers in the state.

Despite of so many efforts for the diversification of agriculture and promotion of CF to combat farmers' distress since 1990s there is a need to look upon whether these efforts have done any good. Have the diversification strategies adopted brought any fruitful results? Is CF really promoting diversification in the state? What are the factors that are causing hindrance to the diversification of agriculture?

To address the above mentioned questions, the study undertakes three objectives. (i) to assess the level of crop diversification in the state of Punjab; (ii) to determine the role of CF in promoting the crop diversification; (iii) and to analyse the factors/determinants that are promoting/retarding the process of diversification.

The paper is divided into five sections. Second section provides the conceptual clarity of the various definitions that revolve around diversification and the methodology used in the study. Third section examines the extent of crop diversification and the CF in Punjab. Fourth section brings out the arguments for CF in the state. Fifth section examines the various factors influencing the diversification and the final section concludes the paper.

CONCEPTS AND METHODOLOGY

The concept of diversification can be classified as:

(a) A shift of resources from farm to non-farm activities (b) Use of resources in a larger mix of diverse and complimentary activities within agriculture and (c) A movement of resources from

low value agriculture to high value agriculture (Joshi, Gulati, BIRTHAL and Tewari 2004). The present paper is using the 3rd strand of diversification for the analysis that is crop diversification.

Different strategies for diversification have been recommended by various scholars and analysts in the state. The Expert Committee on Diversification of Agriculture in Punjab, known as Dr. S. S. Johl Committee (1986), recommended that 20 per cent of the area under wheat and paddy must be shifted to fruits, vegetables and fodder cultivation (HDR Punjab, 2004). Owing to the severity of agrarian and ecological crisis in the state, another committee headed by Dr. S.S. Johl (2002) suggests that one million hectare area under wheat and rice needs to be shifted to other crops like oilseeds and pulses, which have less water requirements and are ecology and soil friendly and farmers who diversify should be compensated by giving Rs. 12,500 per hectare (Sharma 2007).

Given the Johl Committee recommendations and to combat agrarian crisis, the Punjab government undertook a programme to encourage diversification through CF.¹ CF is a system of production in which a central processing unit or export processing unit supplement or substitute their production by entering into an advance agreement with the farmers to supply specified produce at specified time and price. And this is mainly practised by food processing firms (Glover 1990; Singh 2002). Thus, it can be said that both crop diversification and the CF are complementing each other. Therefore, there is need to analyse CF as a tool to crop diversification.

Methodology

The study is based on time-series data for the time period 1970-71 to 2008-09 collected from various issues of Statistical Abstract of Punjab. Share of different crops in Gross Cropped Area (GCA) has been calculated for each decade to show the cropping pattern in the state. Further, Simpson Index of Diversity (SID) has been calculated to capture the extent of diversification in the state.

$SID = 1 - \sum P_i^2$ where $i = 1, 2, \dots, n$. and P_i is the proportional value (or area) of the i^{th} crop in the total value (area) of output. When SID is close to one it implies that the diversification increases and when SID is close to zero, there is no diversification.

The paper has reviewed the various studies on CF to understand its importance to reduce the impact of agrarian crisis. It divides the supply side and demand side factors that bring out the case for CF.

To identify the determinants of diversifications, the time series OLS model has also been estimated. The model further divides the determinants into two categories namely demand side factors and supply side factors.

EXTENT OF DIVERSIFICATION AND CONTRACT FARMING IN PUNJAB

The extent of diversification in Punjab is measured through the share of individual crops in GCA and which is presented in Table 1. The share of individual crops to GCA for each decade was calculated by finding the average values of share of individual crops and GCA for the decade.

It shows that the share of area under wheat in GCA was 40.45 per cent in 1970-80 which increased to 43.37 per cent during 1980-90 and was 42.62 per cent in 1999-2000 showing a marginal decline but it again increased to 43.73 per cent in 2000-09. Similarly, share of rice in GCA was 10.94 percent in 1970-80 and accentuated to 33.08 per cent in 2000-09. These trends clearly depict the prevalence of wheat-rice monoculture in Punjab. The share of area under bajra

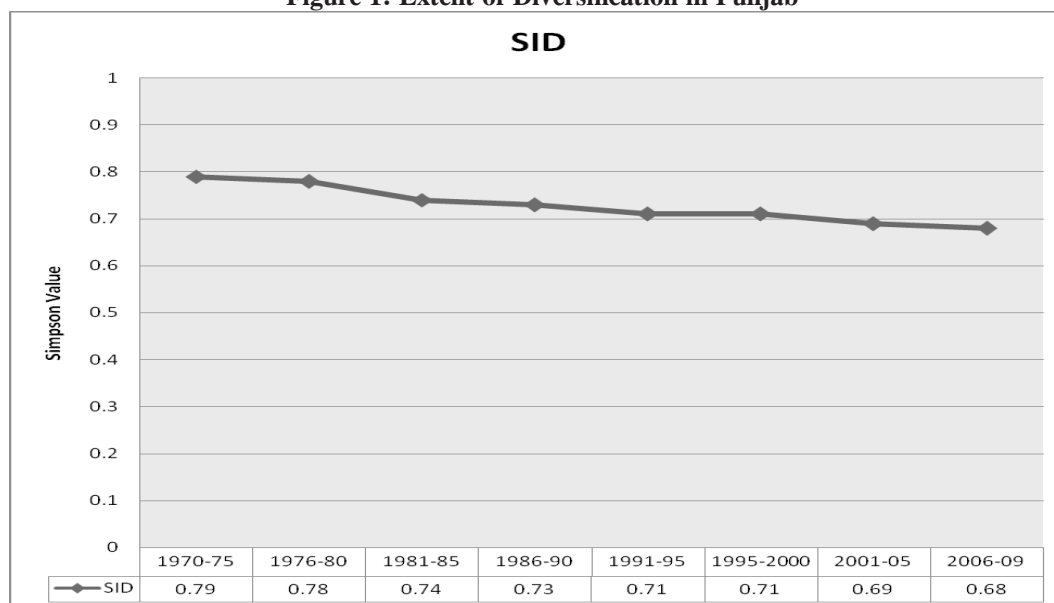
has become almost negligible from 2.18 per cent in 1970-80 to 0.08 per cent in 2000-09. The share of area under maize has plummeted from 8.36 per cent in 1970-80 to 1.97 per cent in 2000-09. The share of area under total pulses to GCA during 2000-09 is merely 0.51 per cent. Area under sugarcane during 2000-09 constituted only 1.41 per cent of GCA. In the same time period, cotton turns out to be an important crop after wheat and rice which alone has share of 6.74 per cent in GCA as compared to the rest of crops. But that too saw a decline in its share over the past two decades. Oilseeds and barley have almost negligible share in GCA in the same time period. Fruits and vegetables also represent the same picture by constituting 0.62 per cent and 1.41 per cent share in GCA. Thus, we conclude that wheat-paddy still dominates the cropping pattern in the state and there has not been any noticeable shift towards other crops.

Table 1
Crop Share in Gross Cropped Area in Punjab

Years	1970-80	1980-90	1990-2000	2000-09
Rice	10.94	22.24	28.94	33.08
Wheat	40.45	43.37	42.62	43.73
Bajra	2.18	0.52	0.11	0.08
Maize	8.36	3.88	2.25	1.97
Barley	1.26	0.78	0.49	0.28
Groundnut	2.47	0.71	0.12	0.05
Rapeseed & Mustard Seed	2.08	1.66	1.01	0.60
Sesamum	0.27	0.21	0.23	0.16
Linseed	0.04	0.02	0.01	0.00
Vegetables	N.A	0.81	1.00	1.41
Fruits	N.A	0.59	0.99	0.62
Total Pulses	6.32	3.07	1.20	0.50
Cotton	8.89	9.04	8.48	6.74
Sugarcane	1.78	1.30	1.46	1.41
Other crops	14.98	11.79	11.09	9.38
Total	100.00	100.00	100.00	100.00

Source: Author's calculation from Statistical Abstract of Punjab (Various Issues)

To statistically examine the extent of diversification, SID was calculated for the four decades. This period was selected as the agriculture of the state was in full bloom in 1970s and in 1980s it began to fizzle out. And soon after that many policies were recommended and adopted to overcome the agrarian problem.

Figure 1: Extent of Diversification in Punjab

Source: Author's calculation from Statistical Abstract of Punjab (Various Issues)

Figure 1 depicts the extent of diversification in Punjab from 1970-71 to 2000-09. The index is 0.79 for 1970-75. It reduced to 0.78 in 1976-80 and was 0.74 and 0.73 in 1981-85 and 1986-90 respectively. Again, it was 0.71 during the period 1990-2000. However, it is worth noticing that after the introduction of government programme to promote diversification there has not been improvement in the SID. Instead, it has further reduced to 0.69 during 2001-05 and 0.68 in 2006-09. This declining trend in the diversification index points out towards the dominance of conventional cropping pattern in the state. The results are consistent with the findings of Singh and Sidhu (2004) and Singh and Sahoo (2007). The downward sloping curve clarifies lack of diversification in the state. It is known that the state specialises in wheat and rice production and contributes substantially to the national food security. Farmers too started preferring wheat-paddy crop rotation due to assured returns, less risks, large and stable markets and comparative cost advantage (Shergill 2005). Hence, there has not been much change in the cropping pattern in Punjab despite of so many recommendations being suggested to combat the crisis. Now there is a need to look upon the status of CF since its inception in 2002-03 as it will give us the true picture of the efforts undertaken to improve the scenario.

Table 2 analyses the extent of CF in the state. It has been calculated by finding the share of area under CF to the GCA.

The percentage share in 2002-03 was merely 0.12 per cent. It increased to 0.96 per cent in 2003-04, and 1.2 per cent in 2004-05. The area under CF remained almost same, hovering around 1 per cent during time period 2004-05 to 2008-09. It declined to 0.97 per cent in 2009-10. Though the decline is meagre but it shows that CF as scheme has not done much to change the scenario of agricultural sector of the state. Table 3 provides gives details of the target area and actual area achieved for various crops under CF. Since, giving information of each and every year is beyond the scope of the paper, details of the initial year of the CF scheme and later years have been provided.

Table 2
Extent of Share of CF in Punjab

Year	Area under contract farming (000 Hectares)	GCA (000 Hectares)	Share of CF (%)
2002-03	9	7826	0.12
2003-04	76	7905	0.96
2004-05	99	7932	1.2
2005-06	87	7868	1.1
2006-07	96	7861	1.2
2007-08	96	7870	1.2
2008-09	84	7912	1.1
2009-10	77	7900	0.97

Source: Author's calculation from Statistical Abstract of Punjab (Various issues)

As per Table 3, in the year 2002-03, many crops were targeted for CF. However, out of 13 crops targeted, CF was undertaken only in 4 crops. Moreover, actual area for CF in 3 crops is very low as compared to the targeted area i.e. in Hyola it is 13.06 per cent of the targeted area, Barley 16.4 per cent and Sunflower 68.63 per cent, but in Maize actual area is more than the targeted area i.e. 105.10 per cent. In later years, very few crops were selected to be undertaken for CF namely Hyola, Barley, Spring corn, Basmati and Kharif Corn. Actual area brought under CF for these crops is very less as compared to the targeted area with the exception of Basmati. However, in the year 2010-11, only Barley is the crop selected to be undertaken for CF which again points out towards the poor performance of the CF scheme. It is worth mentioning here that initially many companies operated through PAFC (indirect CF) but at present only one company is involved in indirect CF i.e. United Breweries. As per the information from PAFC, the major driving force for the companies to do indirect CF was the concession given by the Punjab State Agriculture Marketing Board in market fee charging 0.25 per cent instead of 2.0 per cent and Rural Development Fee 0.25 per cent instead of 2.0 per cent.

Thus, making an aggregate reduction of 3.5 per cent, that made the procurement of agricultural produce very competitive for the processors. But this concession has been withdrawn by the Government of Punjab. Therefore, either companies had quit CF or are involved in direct CF.

Now there is need to look upon why wheat-paddy rules the farms of Punjab? Punjab has been a pioneer in ensuring national food security. It's agriculture at the time of inception of green revolution was structured to produce food in response to the national requirements to augment food grain

Table3
Target Area and Actual Area under Contract Farming
Scheme in Punjab (Area in hectares)

Crop /Year	2002-03			2009-10			2010-11
	Targeted Area	Actual Area	Actual area as % of target	Targeted Area	Actual Area	Actual area as % of target	Targeted Area
Hyola	30000	3919.20	13.06	24281	7412	30.5	-
Barley	2000	328	16.40	6070	3315	54.6	6070
Winter maize	1200	1261.20	105.10	-	-	-	-
Durum wheat	40000	-	-	-	-	-	-
Sunflower	5000	3416.40	68.63	-	-	-	-
Spring corn	2000	-	-	16188	9710	59.9	-
Basmati	10000	-	-	24281	30317	124.8	-
Kharif corn	60000	-	-	40469	23705	58.6	-
Guar gum	2000	-	-	-	-	-	-
Castor	2000	-	-	-	-	-	-
Groundnut	400	-	-	-	-	-	-
Organic Basmati	400	-	-	-	-	-	-
Vegetables	800	-	-	-	1122	-	-
Others	4200	-	-	-	4062	-	-
Total	160000	8924.80	5.58	111287	79643	71.5	6070

Source: Punjab Agro Food grain Corporation, Chandigarh.

production particularly wheat and rice and contributing a major chunk of wheat and rice to the central pool. It has contributed 42.2 per cent of wheat and 29.5 per cent of rice to the central pool during the year 2009-10. The total contribution of wheat and rice to the central pool has increased from 115.6 lakh tonnes in 1990-91 to 200.1 lakh tonnes during 2009-10 consisting of 107.3 lakh tonnes of wheat and 92.8 lakh tonnes of rice. Thus reduction in area under wheat and rice would endanger national food security. Also, there is no more scope to increase area under agriculture

in the state as it has already reached the saturation level where almost 99 per cent of cultivable land is under plough (Economic Survey 2010-11). Thus, diversifying to other crops would imply reduction in area under wheat and paddy. Therefore, the support from the central government to shift to alternate crops is least expected as it will hamper the food security.

Not only this, the cropping pattern made the economy self-sufficient in food grains but it also brought immense gains and prosperity to the farmers of Punjab. Punjab ranked number one in per capita income across major Indian states during 1999-2000 (Singh 2010). Since this cropping pattern brought immense returns in the past, it has created loyalty in the minds of farmers and they are reluctant to take risk by shifting to other crops. But the gloomy side shows that small and marginal farmers are unable to take risks by shifting to other crops due to dearth of capital, skill and technology (Singh 2002). This also becomes one of the reasons for the farmers to cling to conventional wheat paddy cropping pattern. Other factors that are responsible for wheat paddy monoculture are high income earnings, high yields, assured minimum support and assured purchase programme for wheat and paddy, comparative cost advantage in wheat-paddy, large and stable market (Shergill 2005). But with the changing times and with the need of the hour there is dire need to shift from this conventional cropping pattern.

ARGUMENTS FOR CONTRACT FARMING

Supply Side Factors

The wheat-paddy monoculture that covers 76.9 per cent of the GCA has led to ecological degradation in terms of depletion of ground water table, depletion of soil health, pollution due to burning of surplus straw, soil salinity due to excessive use of fertilisers, water logging, micro nutrient deficiency (Chand 1999; Kalkat 2008). As per *Economic Survey (2010-11)*, the ground water table has fallen drastically due to excessive use of irrigation facilities in order to increase agriculture production of the state mainly of wheat and paddy. The water table in 9,058 sq.kms of central Punjab has gone down by more than 20 metres in the past one decade and the trend is continuing with some districts registering a decline despite of a good monsoon last year. As per the latest figures by the Central Ground water Board, the ground water has fallen in 42,170 sq km area which is about 84 per cent of the state's area. The worst hit districts are Nawanshahr, Jalandhar, Kapurthala, Moga, Patiala, Ropar, Fatehgarh Sahib, Sangrur, Mansa, Bathinda, Hoshiarpur, Gurdaspur and Amritsar. Of the 137 blocks assessed by the board, 103 fall under 'over-exploited' category, 5 in critical and 4 in semi-critical categories. The board has held paddy responsible for such condition that consumes six times more water than maize, 20 times more water than groundnut and 10 times more than other Kharif crops. Thus, reduction in area under paddy has been urged as a solution (The Tribune, February 25, 2012).

Table 4
Percentage Share of Gross Irrigated Area to Gross Cropped Area

Year	Percentage of GIA to GCA
1970-71	74.7
1980-81	85.4
1990-91	94
2008-09	97.6

Source: Statistical Abstract of Punjab (Various issues)

The use of fertilizers has become unavoidable due to increase in production of food grains. The consumption of fertilizers is given in the Table 5.

Table 4 shows the increase in irrigated area to support the above argument. The increase in figures from 74.7 per cent in 1970-71 to 97.6 per cent in 2008-09 depicts excessive use of irrigation facilities in the state.

Table 5
Consumption of Fertilizers (000 Nutrients Tonnes)
(Triennium Ending)

Year	Total (NPK)	Percentage change
1971-72	276	-
1975-76	304	10.1
1980-81	754	147.3
1985-86	1087	44.3
1990-91	1209	11.2
1995-96	1252	3.6
2000-01	1389	11.0
2005-06	1646	18.5
2007-08	1778	8.0

Source: Statistical Abstract of Punjab (Various issues)

Table 5 shows that the consumption of fertilizers increased tremendously in early 80s when the green revolution was in its full youth. The consumption of fertilizers is still on increase, though the rate of increase has slowed down. But the excessive use of fertilizers has already shown its consequences on soil health.

The declining growth rate of agriculture, declining incomes and profitability, burgeoning indebtedness of farmers are the other issues that has made the government to think of undertaking risk by shifting to other crops gradually. The growth rate of agriculture was 4.87 per cent during 1980s but it was merely 0.36 per cent during 1990s (Singh 2004; Jodhka 2006). According to the *Economic Survey of Punjab (2010-11)*, the contribution of primary sector in the Gross State Domestic Product has dipped from 32.53 per cent in 2004-05 to 24.92 per cent in 2009-10. On the farmers' side, problem of indebtedness is on rise due to increase in cash expenditure on crop production. This rise in cost of production is due to rise in prices of inputs and increase in use of inputs due to depletion in soil health and environment. The negative growth rate in per hectare rate of return on wheat and paddy in the 1990s has led to a reduction in the incomes of the farmers (Human Development Report Punjab 2004; Jodhka 2006). Thus, the paucity of resources forces the farmers to borrow from external sources and thus the inability to pay the debt due to falling incomes and profits lend them into the situation of debt trap. The farmers of Punjab were indebted to the tune of 65.4 per cent in 2002-03. Out of which, marginal farmers constitute 53.3 per cent share in indebtedness, small farmers 15.8 per cent, semi medium 17 per cent, medium farmers 11.8 per cent and large farmers constitute 2.2 per cent of the indebted farmers (NSSO 2005).

Thus, the worst sufferers are the marginal farmers. This profound situation of indebtedness has led to the incidence of farmers' suicides. Around 5,000 farmers and farm labourers committed suicide in the state during the decade 2000-2010 (The Tribune, May 27, 2012). Economic causes like indebtedness, lack of resources and crop failure, social causes like lavish family functions and drug addictions are feared to be responsible for this gloom. Such pernicious situation has forced the farmers to leave agriculture and shift to non-agricultural activities. The cultivators were 53.64 per cent of the total rural work force in 1971, 46.11 per cent in 1981, 44.39 per cent in 1991 and dipped to 31.5 per cent in 2001 and whereas agricultural labourers accounted 24.79 per cent in 1971, 44.39 per cent in 1991 and it declined to 31.5 per cent in 2001 (Gill 2005). Also, with the over mechanisation of agriculture the labour absorption capacity of agriculture has reached a saturation point. Agriculture today provides less employment days as compared to the period 1961-84. Agriculture provided employment to 63 per cent of the total work force in 1971, 58 percent in 1981, 55 per cent in 1991 and 39 per cent in 2001 (Human Development Report Punjab 2004).

Thus, such a dismal state of Punjab's agriculture has become a cause of concern and accentuates the need to bring variations in Punjab's agriculture that can be attained either through shifts in crop or through technological changes or value addition. CF widely practised in many developed countries has been rendered as a channel to attain diversification in terms of value addition and shift to other crops than wheat and rice and also a gateway to new opportunities of employment and income (Singh L and Singh S 2002; Singh 2004; Kumar 2006). Farmers of Punjab plunged in a quagmire need a push in terms of capital, better inputs, new skills and technology. Moreover, the development of agro-processing industry can also reduce the problem of post-harvest losses due to unavailability of warehouse and storage facilities and adequate marketing structure (Kachru 2006).

Demand Side Factors

Globalization has ushered dynamism to all the sectors and agriculture is no exception to this. With the increasing globalization, increasing trade opportunities, cost competitiveness, emphasis on value addition through standardization, change in Indian diet, there is a need to develop alternative marketing models like CF (Agriculture Summit 2004-05). With increasing urbanization, growing incomes, increase in female work participation there is increase in demand for processed and semi processed foods. Urbanization in Punjab has increased from 34 per cent in 2001 to 38 per cent in 2011. During this decade urban population of Punjab has increased by 25.72 per cent which is nearly twice that of the overall growth rate (13.73 per cent) and more than thrice the rural growth rate (7.58 per cent) (Census of India 2011). Also as per the estimates of *State Development Report on Punjab (2002)*, the percentage of female work participation rate has increased from 4.4 per cent in 1991 to 18.7 per cent in 2001. This increase indicates that with more working women, the demand for value added and ready to eat products is bound to increase. Such an increase is a positive indicator for the growth of high value commodities. Thus, there is an ample scope for agro processing industry to develop in Punjab and open new avenues of development. This agro industry will not only develop the industrial sector of the economy but at the same time it will also boost the growth of the agriculture sector by creating demand for agriculture output as its raw material. The earlier experiences of CF in other countries like Thailand, Zimbabwe, Sub Saharan Africa and other South Asian countries although exhibited mixed experiences but it gives enough reason to replicate the trends in India. For instance, CF in Thailand has resulted in better overall agricultural growth, development effects through shift to high value crops, reduction in transaction cost, increase profitability, decline in rural poverty, intensification of agriculture production and expansion of agro industry (Sununtar, Leung and Cai 2006; Wiboonpoongse and Sriboonchitta

2008). CF in Sub Saharan Africa has contributed to accumulation of capital assets essential for sustaining rural livelihoods (Jacobson 2010). CF in Zimbabwe alleviated uncertainties associated with local markets, enhances skill applications and augments income levels (Masakure and Henson 2005). The experience of other countries in CF with positive results spurs its adoption in India.

DETERMINANTS OF CROP DIVERSIFICATION IN PUNJAB

The present paper tries to examine the extent of diversification and the underlining factors behind this process. In the present analysis, diversification refers to crop diversification.

Crop Diversification depends on various factors that can be divided into demand-driven and supply-driven factors. The demand side factors are urbanization, literacy rate and per capita income. The supply side factors generally cover infrastructure facilities like irrigation, electricity, road length, marketing societies and fertilizers. The demand side factors like urbanization rate and literacy rate were not selected as variables as the data used is time-series data for the analysis. Per capita NSDP (Rs in thousands) was dropped from the analysis as it created the problem of multicollinearity. However, It was expected that per capita NSDP is positively related with diversification as the income increases demand for high value commodity in household consumption increases (Singh and Sahoo 2007; Joshi, Gulati and Tewari 2004).

The supply side factors like percentage electricity consumption in agriculture, proportionate area under non-foodgrain crops, number of marketing societies per 1000 ha GCA and Road length in Kms per 1000 GCA are expected to be positively associated with SID as better infrastructure is a pre-requisite for diversification (Singh and Sahoo 2007). The other supply side factors like fertilizer use Kg per ha GCA and proportion of GIA to GCA (%) are expected to be negatively related to diversification. Since, traditional cropping pattern of wheat-paddy consumes excessive fertilizers and irrigation as argued previously, it is expected that shift towards other crops will reduce their usage. Fertilizer consumption was also dropped due to problem of multicollinearity. Lagged value of SID (SID_{t-1}) was also included as independent variable to know its impact on diversification.

Following variables were finally included for the analysis (i) proportionate area under non-foodgrain crops (%) (NFood) (ii) percentage use of electricity in agriculture (Elec) (iii) availability of primary marketing and processing societies per 1000 ha of GCA (Mkt) (iv) proportion of GIA to GCA (%) (Irr) (v) road length in Kms per 1000 ha of GCA (Road) and (vi) lagged values of SID (SID_{t-1}). The dependent variable is defined as Simpson Index of Diversity (SID). Value of SID lies between zero and one. To statistically test the hypothetical variables stated above, which may have an impact on diversification, a time series OLS model have been employed for the time period 1970-2008. The results of the models are given in the Table 6.

Magnitude of R^2 and F-value in the model indicates that model is a good fit. The D-W statistic also falls in no autocorrelation region in the model. R^2 of value 0.983 in model shows that about 98 of time variation in the dependent variable (SID) is explained by the variation in the explanatory variables.

The result indicates that Road has positive impact on diversification as expected. The results are consistent with the findings of (Joshi, Gulati, Birthal and Rao 2005; Singh and Sahoo 2007). Better road network allows farmers easy and quick disposal of perishable goods. NFood also has positive relation with SID. Area under non-foodgrain is bound to have positive relation with SID as more area under non-foodgrain implies more diversification. Irrig have statistically significant negative impact on diversification. The result is consistent with the findings of (Joshi, Gulati,

Birthal and Rao 2005; Singh and Sahoo 2007). It can be said that with more irrigation facilities, farmers tend to produce traditional crops like wheat and rice. Thus, diversification may solve the problem of excessive use of irrigation in the state. Mkt and Elec turn out to be insignificant. However, the signs are as per the expectations.

Table 6
OLS Estimates using the 38 observations 1971-2008
Dependent Variable: SID

Independent Variables	Model
Const	0.444*** (0.093)
Elec	0.000008 (0.000)
Irr	-0.001** (0.000)
NFood	0.005*** (0.001)
Mkt	1.848 (1.320)
Road	0.004** (0.002)
LSID	0.292*** (0.081)
Unadjusted R ² = 0.986 Adjusted R ² = 0.983 Durbin-Watson Test = 1.504 F-statistic = 356.962***	

* denotes significant at 10 per cent, ** significant at 5 per cent and *** significant at 1 per cent

Parentheses indicate standard errors.

CONCLUSION

This paper attempts to capture the extent of diversification and contract farming in the state. The study is based on 39 years' time-series data for the time period 1970-2008. Simpson Index of Diversification (SID) is used to measure the extent of diversification; OLS regression analysis finds various determinants of diversification. The main findings of the study are:

- 1) Proportionate share of wheat and rice in GCA has increased over the years. This cropping pattern still dominates with wheat constituting share of 43.73 per cent and rice 33.08 per cent during the decade 2000-09.
- 2) Trend in SID shows lack of diversification in the state with SID declining over the years.
- 3) Area under CF has declined in 2008-09 and 2009-10. Actual area brought under CF for most of the crops is much below the targeted area during all the years.
- 4) The results of OLS regression indicates that irrigation is negatively associated with diversification and road length, proportionate area under non foodgrain crops have positive impact on SID.

It can be concluded that diversification has been rendered as a solution and many efforts have been made by the government to achieve the same. But these efforts appear to be diminutive as since the inception of diversification programme no considerable progress has been made. The

model of CF has been proposed as a tool to encourage crop diversification. Many scholars have argued in favour of CF that it can reduce the burden of agrarian crisis. But its progress is very slow due to the fact that there are policy factors that still encourage wheat and rice cycle. Serious efforts need to be made to bring changes in the agrarian economy of the state. For this, strong policy framework and public-private partnership should be encouraged in the state.

References / Notes

Notes

1. <http://punjabagro.gov.in/paic.html>
2. a political party in Punjab.
3. <http://punjabagro.gov.in/pafc.html>

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