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# Sustainability in Agriculture: Case Study of Baby Corn Production in Punjab State

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## ABSTRACT

Sustainability in agriculture is more relevant today than at any point in time earlier. The need to increase farm produce while preserving natural resources, judicious use of chemicals and pesticides and to increase farm incomes from reduced lands under agriculture is the real challenge. Realization is building up in this regard and few large companies have incorporated appropriate practices to make farming remunerative and sustainable. Field Fresh has made its presence in this sector by establishing relationship with its partner farmers to grow exotic vegetable i.e baby corn in Punjab state. The study has examined the production and input use patterns of baby corn in Jalandhar and Ludhiana districts. Season-wise analysis shows that average yields of season II was significantly different from season I and III. District wise comparisons shows that the average yields of baby corn was marginally higher in Ludhiana compared to Jalandhar in all three seasons.

**Keywords:** Field Fresh, partner farmers, baby corn production, JEL Classification: C12, Q12, Q15.

## 1. INTRODUCTION

Agriculture is the main stay of Indian population as almost 85% of the population stays in villages and agriculture is the main occupation in the rural areas. However, communities engaged in agriculture have consistently found it extremely hard to earn enough to even cover the cost of inputs into their small- holdings. To that extent agriculture activities undertaken by them have historically been unsustainable. Moreover, large chunks of lands under cultivation are being converted to industrial use, thereby necessitating higher yields to be obtained from the existing land holdings under agriculture. Towards this end sustainability in agriculture assumes great importance and needs to be implemented on priority. Sustainable agricultural activities involve judicious use of all ingredients like soil, water, nutrients, pesticides, manures, etc. It would involve a paradigm shift in looking at changing the agricultural sector from production orientation to profit oriented activities.

The Fruits and Vegetables (F&V) sector has been a driving force in stimulating a healthy growth trend in Indian agriculture. Given the rising share of high value commodities in the total value of agricultural output and their growth potential, this segment is likely to drive agricultural growth in the years to come (ASSOCHAM, 2013). It plays a unique role in India's economy by enhancing the income of farmers. The growing importance of vegetables in India's economy can be well appreciated in terms of their increasing export potential; need for providing employment opportunities in the rural area, and vegetables being relatively more remunerative crops.

Baby corn is a new entrant in this sector. Its cultivation for exports had been introduced during the early 1970s by Thailand and later by other countries such as Guatemala, Zambia, Zimbabwe and South Africa whereas India is a recent entrant (Pandey *et al.*, 2010). In India its cultivation is picking up only now in a serious way in Punjab, Haryana, Maharashtra, Karnataka and Andhra Pradesh. Today many farmers in different parts of the country are taking up contract farming of baby corn on behalf of food processing companies. The companies supply the farmers with high quality inputs - including hybrid seeds - besides cultivation know-how. The harvested crop is then bought from the farmers at a predetermined price. This crop is processed and then mainly exported to the overseas market. With an assured market for their produce and enhanced income, farmers are finding baby corn an attractive crop to cultivate.

Baby corn is the young, finger-length fresh maize ear harvested within 2 or 3 days of silk emergence but prior to fertilization (Almeida *et al.* 2005; Siliva *et al.* 2006; Mahajan *et al.* 2007; Muthukumar *et al.* 2007; Saha *et al.* 2007). Dehusked baby corn is consumed fresh as well as frozen and canned as a vegetable while its by products such as tassel, young husk, silk and green stalk can be used as animal feed. Baby corn is a vegetable crop that can potentially improve the economic status of farmers. Globally, as an immature vegetable, baby corn has attracted an increasing number of peoples' preference due to the enhancement of living standards and shift in dietary habit from non-vegetarian to vegetarian; however, the production areas are still confined to a few countries, including Thailand, Indonesia, India, and Brazil (Aekatasanawan 2001). Presently, there are two companies engaged in the production and exports of baby corn from India, namely Field Fresh Foods Pvt Ltd, a subsidiary of the Bharti Enterprises and Namdhari Fresh. Namdhari Fresh has its production base concentrated primarily in Karnataka state near Bangalore. On the other hand, Field Fresh Foods Pvt Ltd has been engaged in its production both in the states of Maharashtra and Punjab each having a share of 75 per cent and 25 per cent. FieldFresh Foods is focused on building a robust Fresh Exports business model in vegetables with baby corn as one of its leading product. This study had been carried out for the partner farmers of Field Fresh Foods Pvt Limited in Punjab state. The production scenario of baby corn in Punjab while making the process sustainable for farmers at grass root levels has been the focus of this study. To this end, it has been carried out with the following objectives

1. To examine the socio economic characteristics of sample farmers.
2. To analyse production patterns of baby corn in Jalandhar and Ludhiana districts.
3. To study the sustainability aspects for the farmers through judicious use of inputs.

## 2. METHODOLOGY

The study had been carried out for the partner farmers of FieldFresh Foods Pvt Limited, a subsidiary of the Bharti Enterprises. The study was based upon primary data. To collect primary data following sample design had been used. Selection of farmers was based on snowball sampling technique. 85 farmers had been selected from Punjab for the analysis. Sample size included 54 farmers from Jalandhar district and 31 farmers from Ludhiana district. Farm level comparisons of baby corn production have been made both for Ludhiana and Jalandhar districts. The analysis was carried out in three seasons; I season starts from January and ends in mid March, II season from June to mid August and III season from September to mid November.

**Data Collection:** Information from farmers had been collected relating to their personal backgrounds, land ownership patterns, cropping patterns and baby corn production patterns. Farming being a family based enterprise data had been collected from the chief farm operator. Data had been collected from the respondents at their residences/farms depending upon their availability and convenience. It relates to the crop production period 2013.

**Statistical techniques:** To analyze the data various simple statistical tools had been used.

1. **Coefficient of variation:** It is a statistical measure of the dispersion of data points in a data series around the mean. It was calculated as follows:

$$C.V = \frac{S.D.}{\bar{X}} \times 100$$

Where,

S.D = Standard deviation

$\bar{X}$  = Mean

2. **Analysis of variance:** ANOVA is a collection of statistical models used to analyze the differences among and between groups. Tukey's post hoc test has been applied when F ratio is significant in ANOVA.

Tukey's test: It is used to make all pair-wise comparisons, since it controls the Type I error rate so that it will not exceed the  $\alpha$  value pre specified in the analysis. It maintains an acceptable level of  $\alpha$  without an excessive loss of power. According to this test two means will be significantly different if the absolute value of their sample difference exceeds

$$w = q_{\alpha}(t, f) \sqrt{\frac{MSE}{2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}$$

Where,

A = level of significance

t = no. of treatments

f = degrees of freedom

$n_1$  and  $n_2$  = number of replication of different treatments

MSE = mean square error

3. **t-test**- It was used to determine if two sets of data are significantly different from each other. It has been defined as:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\bar{X}$  = sample means

$s^2$  = unbiased estimator of the variance of the two samples

$n_i$  = number of participants in group  $i$ ,  $i = 1$  or  $2$

### 3. RESULTS AND DISCUSSION

**Background characteristics of respondents :** Table 19.1 reveals that the average age of sample respondents was 46.67 years indicating 21.02 per cent variations around the mean. Average schooling was 12.46 years, indicating variations of 28.61 per cent around the mean. All the sample farmers owned mobile phones (with an average number of 2.54 in the family) whereas only 45.88 per cent of them had landline connections (one each in family). Overall average family size was 6.29 that comprised of 2.53 males, 2.20 females and 1.56 minors. Average annual income of the sample respondents was Rs.4,42,235.30 (it varied from Rs.50,000 to Rs.16,00,000 per annum) showing variations of 85.56 per cent around the mean.

**Table 19.1**  
**Average background characteristics of sample respondents**

<i>Characteristic</i>	<i>Mean</i>
Age (yrs)	46.67 (21.02)
Schooling (yrs)	12.46 (28.61)
Mobile phones (No.)*	2.54 (49.54)
Family size (No.)	6.29 (38.90)
Males	2.53 (33.18)
Females	2.20 (45.35)
Minors (<18 yrs)	1.56 (94.30)
Annual income (Rs.)	442235.30 (85.56)

\*Only 45.88 per cent of them had landline phone (one each) and figures in parentheses indicate C.V

**Age groups :** Table 19.2 depicts that 72.94 per cent of the sample respondents' were above 40 years of age. 21.18 per cent of them lied in the 30-40 age-group whereas only 5.88 per cent of them lied in the age group of 18-30 years. This shows that comparatively more experienced farmers had shown tendency for adoption of this new exotic crop.

**Table 19.2**  
**Breakup of sample respondents according to age**

<i>Age group (yrs)</i>	<i>No.</i>	<i>%age</i>
18-30	5	5.88
30-40	18	21.18
40-50	32	37.65
>50	30	35.29

**Education levels :** Table 19.3 represents that schooling of the largest majority of sample respondents i.e 49.41 per cent was Matriculation, it was followed by Senior secondary at 22.35 per cent. 11.76 per cent of them had college level education and 10.59 per cent had schooling only up to Primary level, while only 2.35 per cent of them were Post-graduates and the remaining 3.53 per cent were illiterates.

**Table 19.3**  
**Breakup of sample respondents according to education**

<i>Education</i>	<i>No.</i>	<i>%age</i>
Illiterate	3	3.53
Elementary	9	10.59
Matriculation	42	49.41
Sr. Secondary	19	22.35
Graduation	10	11.76
Post-Graduation	2	2.35

**Income levels :** Table 19.4 represents that largest majority of sample respondents i.e 58.83 per cent lied in the income range of Rs.1.00 to Rs.5.00 lakhs per annum, followed by 21.18 per cent in the range of Rs.5.00 to Rs.10.00lakhs and only 8.24 per cent respondents had income above Rs.10.00 lakhs per annum.

**Table 19.4**  
**Breakup of sample respondents according to annual income**

<i>Income levels(Rs.)</i>	<i>No.</i>	<i>% age</i>
50,000-1,00,000	10	11.76
1,00,000-2,00,000	24	28.24
2,00,000-500,000	26	30.59
5,00,000-10,00,000	18	21.18
Above 10,00,000	7	8.24

**Table 19.5**  
**Family compositions of sample farmers**

<i>Family type</i>	<i>No.</i>	<i>% age</i>	<i>Mean</i>
Nuclear	33	38.82	4.33
Joint	52	61.18	7.54
<i>Family size</i>			
Nuclear	No.		Mean
Males	75		2.27
Females	45		1.36
Minor	23		0.70
Joint			
Males	140		2.69
Females	142		2.73
Minor	110		2.12

**Family structures :** Table 19.5 indicates that 61.18 per cent of the sample respondents had joint families while the remaining 38.82 per cent had nuclear families. Average sizes of the families for the two stood at 7.54 and 4.33 respectively. Average number of males and females for the nuclear families was 2.27 and 1.36 while for joint families 2.69 and 2.73 respectively. Average number of minors in nuclear families was 0.70 whereas 2.12 in joint families. It can be concluded from the table that among the sample respondents primarily there was prevalence of joint family systems but the number of males in such families stood only marginally higher to the nuclear families.

**Land ownership pattern :** Table 19.6 depicts that 97.65 per cent of the sample respondents owned land (land holding sizes ranged from one to 70 acres) for cultivation but 1.18 per cent of the farmers leased out the entire land. 84.71 per cent sample farmers also leased in farm land (its size ranged from two to 200 acres). Among them, 3.53 per cent farmers depended entirely upon the leased in land for cultivation whereas remaining 84.71 per cent leased it to enhance the holding sizes. This was because of the locational difference of land enabled him earn higher income by renting out his land and paying a lower rent on the leased-in land. In the total cultivated land, share of owned land was 31.85 per cent, leased-in land was 67.89 per cent whereas leased out land was only 0.26 per cent. Average size of operational holdings was 12.16 acres of owned land and 26.25 acres of leased-in land.

**Table 19.6**  
Land ownership pattern of sample respondents

<i>Characteristic</i>	<i>Farmers</i>		<i>Cultivated area</i>		<i>Mean (acre)</i>
	<i>No.</i>	<i>%age</i>	<i>Total (acre)</i>	<i>%age</i>	
Owned	83	97.65	1033.95	31.85	12.16
Leased-in	72	84.71	2204	67.89	26.25
Leased-out	1	1.18	8.50	0.26	8.50
Overall	-	-	3229.45	99.74	-

**Cropping pattern :** Table 19.7 shows that during *rabi* season 76.47 per cent of sample respondents sowed baby corn with an average cultivated area of 6.75 acres and during the *kharif* season, 67.06 per cent of them sowed baby corn with an average cultivated area of 6.04 acres whereas only 55.29 per cent of the farmers sowed baby corn with an average cultivated area of 6.42 acres during the intermediate season.

It also indicated that the major crops during the *rabi* season were wheat, followed by potatoes whereas it was paddy, followed by maize during the *kharif* season, 78.82 per cent and 41.18 per cent of farmers with an average cultivated area of 23.37 acres and 28.76 acres allocated 48.49 per cent and 31.16 per cent of the total cultivable areas during the *rabi* season to wheat and potatoes respectively whereas 90.59 per cent and 17.65 per cent farmers with an average area of 30.90 acres and 23.30 acres allocated 73.68 per cent and 10.82 per cent areas during the *kharif* season to paddy and maize respectively.

**Table 19.7**  
Cropping pattern of sample respondents

<i>Crop/Season</i>	<i>Farmers</i>		<i>Cultivated area</i>	
	<i>No.</i>	<i>%age</i>	<i>Average (acres)</i>	<i>%age of GCA</i>
<i>Baby corn</i>				
Rabi (Jan-Mar)	65	76.47	6.75	13.59
Kharif (June-Aug)	57	67.06	6.04	10.67
Intermediate (Sep-Nov)	47	55.29	6.42	-
	<i>Other crops</i>			
	<i>Rabi</i>			
Wheat	67	78.82	23.37	48.49
Potato	35	41.18	28.76	31.16
Sunflower	2	2.35	35.50	2.20
Muskmelon	3	3.53	15.67	1.46
Mentha	3	3.53	15.33	1.42
Fodder	5	5.88	7.00	1.08

<i>Crop/Season</i>	<i>Farmers</i>		<i>Cultivated area</i>	
	<i>Baby corn</i>	<i>No.</i>	<i>%age</i>	<i>Average (acres)</i>
Watermelon	1	1.18	16.00	0.50
Onion	1	1.18	3.00	0.09
	<i>Kharif</i>			
Paddy	77	90.59	30.90	73.68
Maize	15	17.65	23.30	10.82
Basmati	7	8.24	10.14	2.20
Sugarcane	2	2.35	16.00	0.99
Fodder	5	5.88	4.50	0.70
Snowpeas	3	3.53	6.50	0.60
Chilli	2	2.35	3.50	0.22
Peas	1	1.18	4.00	0.12

### Baby corn scenario

**Area Allocation :** Table 19.8 depicts that from the total cultivated area under baby corn i.e 1084.95 acres total production stood at 31,176.25 quintals. Average yield of baby corn was 28.49 quintals per acre. Season-wise comparison of the shares of areas and production of baby corn indicates that the share of season I (42.70 per cent) was highest in production, followed by season III *i.e.* 29.03 per cent and was 28.27 per cent for season II whereas baby corn cultivated area was highest in season I (40.46 per cent), followed by season II *i.e.* 31.75 per cent and was 20.79 per cent in season III. It was due to the difference in average yields of baby corn during the three seasons. It stood at 30.15 quintals per acre for season I, 25.49 quintals per acre for season II and 29.85 quintals per acre for season III indicating that it remained lower for season II compared to I and III. The analysis depicts that average yields of season II was significantly different from season I and III.

**Table 19.8**  
**Baby corn area, production and yields patterns of sample respondents**

<i>Season</i>	<i>Area (acres)</i>	<i>Average yield (qtls/ acre)</i>	<i>Total production (qtls)</i>
I	439 (40.46)	30.15a	13313.5 (42.70)
II	344.45 (31.75)	25.49b	8812.75 (28.27)
III	301.5 (27.79)	29.85a	9050 (29.03)
Total	1084.95	28.49	31176.25

Figures in parentheses indicate percentages. Figures followed with different superscript are significantly different ( $p < 0.05$ )

**Material Inputs :** Field Fresh assisted the associated famers with well researched scientific inputs to increase their farm produce thus making the whole process sustainable in the long run. Table 9 indicates that the sample farmers treated seeds before sowing for its protection from various disease; used DAP, zinc, potash and sulphate for plant growth. They used 49.79 grams of gaucho per acre for seed treatment, 75.43 kg per acre DAP, 108.71 kg per acre urea whereas, 40.43 kg per acre of potash, 6.18 kg per acre of zinc and 4.30 kg per acre of sulphur were used. Around one litre stomp or atrazine were used to control weeds and two sprays of Regent (0.39 litre) and Basathrin (0.18 litre) were applied to control insect pests. Average prices of sulphur, zinc, DAP, potash and urea stood at Rs.37.22 per kg, Rs.28.76 per kg, Rs.23.75 per kg, Rs.8.65 per kg and Rs.5.47 per kg respectively. Average prices of herbicides and pesticides stood at Rs.368.81 per litre, Rs.750 per litre (Regent) and Rs. 230 per litre (Basatharin) respectively.

**Table 19.9**  
**Input use pattern of baby corn contract farmers per acre**

<i>Item</i>	<i>Input Use Quantity</i>	
	<i>Contract farmers</i>	<i>Company farm</i>
Seeds (kgs)	7.00	7.50
Seed Treatment (kgs)	0.05	0.05
Fertilizers(kgs)		
DAP	75.43	100
Urea	108.71	110
Potash	40.43	50
Zinc	6.18	10
Sulphur	4.30	-
Insecticides and pesticides(ltr)		
Herbicide	0.90	1.00
Pesticides 1	0.39	0.40
Pesticides 2	0.18	0.20
Gypsum (kg)	-	1500
Micronutrient spray	-	0.30

**Total production patterns-District wise scenario :** Table 19.10 depicts that 63.53 per cent of the sample respondents from Jalandhar district contributed 66.13 per cent of the cultivated area and contributed 65.97 per cent to its production. 36.47 per cent growers from Ludhiana district cultivated 33.87 per cent of the cultivated area and contributed 34.03 per cent to its production. Thus the shares of sample respondents from Jalandhar district both in baby corn area and production stood marginally higher in total number whereas for those from Ludhiana district it stood lower to their shares in total number of farmers. In Jalandhar district the percentage of farmers who cultivated baby corn stood comparatively higher in season I (79.63 per cent) whereas in season II (74.19 per cent) in Ludhiana district. Comparison of the season-wise shares of production indicated that in Ludhiana district the share of seasons I and II stood comparatively higher i.e. 44.60 per cent and 33.47 per cent as compared to 41.72 per cent and 25.58 per cent in Jalandhar district whereas in Jalandhar district for season III share was 32.69 per cent and 21.92 per cent in Ludhiana district.

**Table 19.10**  
**District-wise and season-wise breakup of area and production of baby corn of sample growers**

<i>Jalandhar</i>	<i>Farmers</i>	<i>Area</i>	<i>Total production</i>
<i>Season</i>	<i>(No.)</i>	<i>(acres)</i>	<i>(qtls)</i>
I	43 (79.63)	283.50 (39.51)	8581.50 (41.72)
II	34 (62.96)	208.50 (29.06)	5261.50 (25.58)
III	32 (59.26)	225.50 (31.43)	6724.50 (32.69)
Total	54 (63.53)	717.50 (66.13)	20567.50 (65.97)
<i>Ludhiana</i>			
I	22 (70.97)	155.50 (42.32)	4732.00 (44.60)
II	23 (74.19)	135.95 (36.99)	3551.25 (33.47)
III	15 (48.39)	76.00 (20.68)	2325.50 (21.92)
Total	31 (36.47)	367.45 (33.87)	10608.75 (34.03)

Figures in parentheses indicate percentages

**Average production scenario :** Table 19.11 shows that the average yield of baby corn was only marginally higher in Ludhiana district compared to Jalandhar in all the three seasons but it was not significant statistically. Season-wise break up shows that the average cultivated area was comparatively higher in Ludhiana district in season I (7.07 acres) whereas in Jalandhar district for season II (6.13 acres) and III (7.05 acres) but the differences werenon significant statistically. Season-wise comparison of average production shows the same, it was comparatively higher in Ludhiana district in season I (215.09 quintals) whereas in Jalandhar district was marginally higher for season II (154.75 quintals) and for season III (210.14 quintals) but the differences werenon significant statistically.

**Table 19.11**  
Average area, production and yield of baby corn in two districts

<i>Season</i>	<i>Area (acres)</i>			<i>Yield (qtl/acre)</i>			<i>Production (qtls)</i>		
	<i>Jal</i>	<i>Ldb</i>	<i>t value</i>	<i>Jal</i>	<i>Ldb</i>	<i>t value</i>	<i>Jal</i>	<i>Ldb</i>	<i>t value</i>
I	6.59	7.07	0.3274ns	30.14	30.18	0.0754ns	199.57	215.09	0.3529ns
II	6.13	5.91	0.2247ns	25.21	25.91	1.5197ns	154.75	154.40	0.0134ns
III	7.05	5.06	1.357ns	28.72	30.33	1.2888ns	210.14	155.03	1.2492ns

“ns” denotes non-significant values

#### 4. CONCLUSION

The study revealed that FieldFresh Foods has been focusing on the best scientific agri practices for the associated farmers that have helped to make their agricultural ventures sustainable over long periods. It has brought in a real transformation in their lives and livelihood since the time they have been associated with FieldFresh Foods. Their association with FieldFresh Foods has provided them with a guaranteed market linkage with transparent pricing and prompt payments. It would be worth summarizing the actions that may lead to enhanced sustainable agricultural activity in the country. Activities that need emphasis encompass Increased irrigation facilities for farmers, developing improved distribution channels of agricultural produce to involve market access, transportation of farm produce, value addition to farm produce through processing, crop rotation to enhance the productivity of soil, improved access to information relating to use of nutrients, pesticides and appropriate seeds and/or planting material, access to financial support in the form of farm loans etc.

Thus Field Fresh has succeeded in sustainable contract farming of baby corn with its partner farmers in Punjab state. The company helped in diversifying cropping patterns, providing scientific inputs for enhanced farm produce and provided assured market of the produce to the farmers and improved their economic conditions.

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