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Sesamum Cultivation in Punjab: Status, Potential and Constraints

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Abstract

Sesamum, once an important oilseed crop, has been loosing its importance on the cropping map of the state agriculture, owing to favourable production and marketing environment for other crops like paddy. The study has reported the trends in area, production and yield of sesamum, its relative profitability, factors affecting productivity and various constraints inhibiting its growth in the state. The area under sesamum that had declined over the years, has shown a little progress due to oilseeds development programmes, initiated by the Govt. during late-1980s. On the comparative economics front, sesamum has been found to provide lower returns as compared to paddy. The benefit cost ratio of sesamum has been found to be 1.36 which shows its profitability in absolute terms, but compared with its competing crop, it is much lower. The state average productivity of the crop has been almost stagnant over the years, reflecting inadequate research efforts for the upliftment of sesamum in the state. The regression analysis has brought out that sesamum productivity can be enhanced by spending more on plant protection measures and human labour for pesticide spray. Major biotic constraints faced by sesamum growers have been identified as diseases and pests, while lack of irrigation and drought have been the major abiotic constraints. To give a boost to the sesamum cultivation in the state, two-dimensional efforts, viz technological upgradation and effective market support are required.

Introduction

Over the years, paddy-wheat cropping system has brought farming in Punjab to a critical juncture, resulting in various ecological, environmental and soil-related problems. Besides, India spends a huge amount of its crucial foreign exchange to importing of edible oils to meet the demand of its ever-increasing population. About 69 per cent of the total import bill of India was

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on edible oils during the year 2004 (Economic Survey, 2004). India would be in a disadvantageous position if prices of edible oils increase in the world market. To contain these emerging ecological problems as well as to lessen burden on the state exchequer, government is now emphasizing on diversification of agriculture in Punjab. The expert committee in 2002 had recommended shifting of 10 lakh hectares of area under paddy-wheat monoculture towards other crops, including oilseeds (Johl, 2002). Therefore, these days emphasis is being laid on increasing domestic production of oilseeds.

Sesamum is the third important oilseed crops after rapeseed/mustard and sunflower, grown in Punjab, constituting nearly 11 per cent of the area and four per cent of the total oilseed production in the state. The area under sesamum declined from 25.6 thousand hectares in 1966-67 to 13.4 thousand hectares in 1989-90 and further to 10.6 thousand hectares in 2004-05 (Statistical Abstracts of Punjab, 2005). The sesamum production is concentrated in the districts of Amritsar, Ferozepur, Gurdaspur and Hoshiarpur in Punjab with more than 75 per cent of its production base. The productivity level of sesamum in the Amritsar and Ferozepur districts is above the state average, but the overall state average productivity of the crop has been almost stagnant over the years, reflecting inadequate research efforts made for the upliftment of sesamum in the state. In view of this backdrop, the present study was undertaken to find the status, potential and constraints in sesamum cultivation in Punjab. The specific objectives of this study were:

(i) To study the district-wise trends in area, production and yield of sesamum in Punjab,

(ii) To evaluate the impact of oilseed development programmes on sesamum cultivation in the state,

(iii) To work out the economics of sesamum and its major competing crops,

(iv) To identify the factors affecting productivity and resource-use efficiency of sesamum, and

(v) To highlight constraints and suggest policy options to strengthen the sesamum production base in the state.

Methodology

This study was based on the secondary data, obtained from various sources and the primary data collected through field survey. District-wise time series data on area, production and yield of sesamum crop in Punjab from 1965-66 to 2004-05 were collected from various issues of *'Statistical*

Abstract of Punjab'. To achieve other objectives of the study, field survey was conducted in Valtoha block of the Amritsar district in Punjab, where there is maximum concentration of sesamum cultivation. Multistage random sampling technique was followed to select the respondents for data collection. From the selected block, two clusters of villages (2-6) were selected. Complete list of farmers growing sesamum crop in a particular cluster was prepared and 25 respondents were randomly selected. Thus, from two clusters, 50 respondents were selected for the detailed study.

Data Collection: The relevant information on inputs used in sesamum cultivation and its major competing crop, outputs obtained, etc. pertaining to the year 2004-05 were collected from the respondent farmers with the help of specially designed schedule.

Analysis of Data: The data on area, production and yield of sesamum were detrended by the method of moving averages. For this, 3-year, 5-year, 7-year and 9-year moving averages were calculated and the 5-year moving average data were retained for analysis on the basis of minimum variation in the data, i.e. the irregular variation. The compound growth rate was calculated by employing the power function given by Equation (1):

$$Y = a\, b^{t} \qquad \ldots(1)$$

where,

Y = Dependent variable (area, production, yield)
a = Constant-term
b = Regression coefficient, and
t = Time variable

Regression Analysis: For regression analysis, sesamum growers were divided into two categories, viz. small farms (≤ 5 ha) and large farms (> 5 ha). To identify the factors affecting the productivity of sesamum, both linear and log-linear production functions were fitted. Several equations were tried by taking different explanatory variables. Best-fit function was determined on the basis of the level of significance of the explanatory variables, the value of coefficient of multiple determination (R^2) and the logical signs of the explanatory variables included in the model. Cobb-Douglas function of the following form was considered the most appropriate for the present investigation:

$$Y = A \prod_{i=1}^{n} X_i^{bi} e^{u} \qquad \ldots(2)$$

where, Y represents the value of productivity per hectare of sesamum; X_i is the selected explanatory variable (per hectare); A is the technical efficiency

parameter; and b_i is the coefficient of production elasticity of the respective variable at the mean level of input used and output obtained. The 'e' is an error-term. The estimated form of the equation becomes:

$$\ln Y = \ln A + \sum_{i=1}^{n} b_i \ln x_i + u$$

$$\ln Y = \ln A + b_1 \ln x_1 + b_2 \ln x_2 + \ldots\ldots\ldots\ldots + b_n \ln x_n + u \qquad \ldots(3)$$

where,

Y = Value of productivity of sesamum crop (Rs/ha)

X_1 = Education of decision - maker (No. of schooling years)

X_2 = Area under sesamum crop (hectares)

X_3 = Value of seed (Rs/ha)

X_4 = Plant protection measures (Rs/ha)

X_5 = Irrigations (No.)

X_6 = Human labour charges (Rs/ha)

X_7 = Machine labour charges (Rs/ha)

The functions were fitted for small and large farm categories separately.

Marginal Value Productivity

Marginal value productivity (MVP) represents the estimated change in gross returns per hectare consequent upon a unit change in the variable under consideration while the level of use of other variables are held constant. Marginal value productivity in the present study was estimated directly from the regression estimates at the arithmetic mean level of input and output, used as follows:

$$MVP_{(xi)} = b_i \frac{\overline{Y}}{\overline{X}} \qquad \ldots(4)$$

where, b_i is the output elasticities of variable X_i and $\overline{X}$ and $\overline{Y}$ are the geometric mean of concerned variables.

Constraint Analysis

Intensity of various biotic and abiotic constraints was studied using five scale rating, viz. very severe problem, severe problem, moderate problem, slight problem, and occurrence but no loss.

Results and Discussion

(i) Trends in Area, Production and Yield of Sesamum

The district-wise trends in area, production and yield of sesamum crop in Punjab from 1965-66 to 2004-05 have been depicted in Table 1. Positive and significant growth in area was seen in the districts of Amritsar, Ferozepur,

Table 1. District-wise trends in area, production and yield of sesamum crop in Punjab: 1965-66 to 2004-05

(Area in '000 ha, production in '000 tonnes, yield in kg/ ha)

District	Estimates of				
	Variables	Mean	C.V.	CGR	R^2
Amritsar	Area	4.4	49.1	3.32**	0.53
	Production	1.7	44.3	2.46**	0.39
	Yield	412.9	11.9	-0.83**	0.51
Ferozepur	Area	1.5	71.5	7.33**	0.77
	Production	0.7	73.5	7.90**	0.80
	Yield	438.1	9.9	0.52**	0.29
Gurdaspur	Area	6.2	39.6	-3.64**	0.67
	Production	1.9	43.2	-4.12**	0.73
	Yield	313.2	8.2	-0.50**	0.40
Hoshiarpur	Area	1.0	29.3	-1.46**	0.34
	Production	0.3	38.5	-3.34**	0.72
	Yield	284.2	21.3	-1.91**	0.70
Jalandhar	Area	0.7	90.4	6.70**	0.42
	Production	0.3	90.1	6.84**	0.49
	Yield	438.5	10.3	0.19	0.03
Kapurthala	Area	0.3	82.3	6.78**	0.67
	Production	0.1	71.5	6.27**	0.70
	Yield	436.7	15.7	-0.53*	0.12
Ludhiana	Area	0.3	82.6	-5.56**	0.38
	Production	0.1	78.5	-4.74**	0.29
	Yield	480.3	29.4	0.85	0.08
Patiala	Area	0.3	67.6	-3.41	0.08
	Production	0.1	47.1	-0.13	0.01
	Yield	500.6	32.9	3.38**	0.37
Ropar	Area	0.9	55.4	-3.32**	0.49
	Production	0.3	61.4	-3.96**	0.54
	Yield	304.8	12.8	-0.67**	0.25
Punjab	Area	16.0	14.7	0.51	0.13
	Production	5.8	14.9	0.37	0.07
	Yield	363.2	4.9	-0.14	0.08

Note: **,* indicate significance at 1 per cent and 5 per cent levels, respectively.

Kapurthala and Jalandhar, while negative and significant growth was observed in the Gurdaspur, Hoshiarpur, Ludhiana, Patiala and Ropar districts. In yield, growth was positive and significant in Ferozepur and Patiala districts only. The coefficient of variation in area varied between 55 per cent and 90 per cent in the Jalandhar, Ludhiana, Kapurthala, Ferozepur, Patiala and Ropar districts, while it was in the range of 29-49 per cent in the Amritsar, Gurdaspur and Hoshiarpur districts. The yield variability was in the range 8-32 per cent in all the districts. Thus, variability in yield was found to be less than variability in area.

(ii) Impact of Oilseed Development Programmes

The impact of Oilseeds Technology Mission on area, production and yield of sesamum in different districts of Punjab is shown in Table 2. The impact of technology in terms of increase in area was observed in Amritsar, Ferozepur, Jalandhar and Kapurthala districts, which was statistically significant. Increase in yield was recorded in the Ferozepur and Ludhiana districts only. Therefore, no major impact of development programmes was observed in terms of increase in yield in the major sesamum growing districts, though in a few districts, it was observed in terms of increase in area.

(iii) Economics of Sesamum and Its Competing Crop

The comparative economics of sesamum and its major competing crop, viz. paddy have been displayed in Table 3. The total variable cost per hectare on sample farms was found to be Rs 4,517 in sesamum and Rs 17,357 in paddy crops. Gross income came out to be Rs 6170 in sesamum and Rs 32,924 in paddy, while returns over variable cost were Rs 1653 and Rs 15,567, respectively. The benefit cost ratio was 1.36 in sesamum and 1.90 in paddy crop. The differences in all benefit-cost parameters were found to be statistically significant. Thus, returns over variable cost were higher by about 10-times in paddy than sesamum. Therefore, despite higher total variable cost, paddy crop was more profitable than sesamum due to higher gross returns.

(iv) Factors Influencing Productivity of Sesamum

The coefficients of the selected regression equations for the sesamum crop on small and large sample farms in Punjab are given in Table 4.

Small Farms: The coefficient of multiple determinations were found to be 0.93, indicating that the yield of sesamum crop was largely influenced by the changes in expenditure on various inputs included in the analysis. The coefficients of expenditure on plant protection measures and human labour

Table 2. Impact of various development programmes on area, production and yield of sesamum crop in various districts of Punjab

(Area in '000 ha, production in '000 tonnes, yield in kg/ ha)

Districts	Variables	Before development programmes (1965-66 to 1985-86)				After development programmes (1986-87 to 2004-05)				Impact of technology (m_2-m_1)	t-value (Cal.)
		Estimates of				Estimates of					
		Mean (m_1)	C.V.	CGR	R^2	Mean (m_2)	C.V.	CGR	R^2		
Amritsar	Area	2.85	14.24	-1.94**	0.5313	6.30	30.99	4.66*	0.3489	3.44**	7.523
	Production	1.28	15.59	-1.80**	0.3545	2.36	34.85	3.88	0.2293	1.07**	5.530
	Yield	449.16	7.49	0.15	0.0113	372.47	7.67	-0.75	0.2255	-76.69	-7.327
Ferozepur	Area	0.59	42.28	6.78**	0.7793	2.58	24.06	-2.28*	0.2469	1.98**	12.833
	Production	0.25	46.28	7.74**	0.887	1.18	22.71	-2.42*	0.3237	0.93**	13.791
	Yield	418.26	10.40	0.87*	0.2132	460.18	6.60	-0.14	0.0114	41.91**	3.312
Gurdaspur	Area	8.13	16.14	1.14	0.1356	4.12	38.26	-7.41**	0.9918	-4.01	-8.328
	Production	2.64	18.16	0.26	0.006	1.24	41.42	-7.76**	0.9827	-1.40	-8.429
	Yield	325.37	8.55	-0.88*	0.2991	299.53	4.63	-0.38	0.1626	-25.84	-3.461
Hoshiarpur	Area	1.10	30.66	-2.57*	0.2514	0.88	19.19	-2.64**	0.4936	-0.22	-2.391
	Production	0.36	26.87	-3.03**	0.4072	0.21	32.73	-6.29**	0.7888	-0.14	-5.112
	Yield	327.95	8.93	-0.48	0.0938	235.35	20.36	-3.76**	0.7441	-92.59	-7.079
Jalandhar	Area	0.26	50.60	-7.48**	0.629	1.12	63.21	15.55**	0.6204	0.86**	5.187
	Production	0.11	41.56	-5.26**	0.5299	0.47	67.56	14.28**	0.5557	0.36**	4.898
	Yield	453.63	16.85	2.36**	0.6124	423.71	10.17	-1.10*	0.2832	-29.93	-1.423

Contd

Table 2. Impact of various development programmes on area, production and yield of sesamum crop in various districts of Punjab — *Contd*

(Area in '000 ha, production in '000 tonnes, yield in kg/ ha)

Districts	Variables	Before development programmes (1965-66 to 1985-86)				After development programmes (1986-87 to 2004-05)				Impact of technology (m_2-m_1)	t-value (Cal.)
		Estimates of				Estimates of					
		Mean (m_1)	C.V.	CGR	R^2	Mean (m_2)	C.V.	CGR	R^2		
Kapurthala	Area	0.12	25.37	4.54**	0.8456	0.58	39.92	-2.60	0.0822	0.46**	8.530
	Production	0.06	32.03	6.13**	0.7628	0.22	33.99	-2.54	0.122	0.16**	9.052
	Yield	473.74	13.78	1.33*	0.2316	395.24	11.28	0.06	0.0007	-78.50	-4.161
Ludhiana	Area	0.44	58.15	0.95	0.0063	0.10	5.65	-0.83	0.25	-0.34	-4.359
	Production	0.19	58.78	2.83	0.0541	0.06	38.78	-9.47**	0.8077	-0.14	-3.926
	Yield	440.84	19.52	1.76*	0.3167	548.46	33.76	-8.65**	0.8189	107.61*	2.178
Ropar	Area	1.34	39.46	0.84	0.0122	0.58	14.82	-2.90**	0.9616	-0.76	-5.854
	Production	0.43	43.81	0.53	0.0043	0.17	27.46	-5.53**	0.8827	-0.25	-5.420
	Yield	314.90	8.26	-0.34	0.0506	293.65	16.02	-2.72**	0.6182	-21.25	-1.701
Punjab	Area	15.24	16.91	0.16	0.0027	16.91	9.93	0.19	0.009	1.67*	2.270
	Production	5.54	16.74	-0.55	0.0369	6.12	10.89	0.06	0.0008	0.59*	2.150
	Yield	364.26	6.23	-0.71**	0.3787	362.00	2.51	-0.13	0.0657	-2.26	-0.384

Note: ** ,* indicate significance at 1 per cent and 5 per cent levels, respectively.

Table 3. Comparative economics of sesamum and major competing crop (paddy) on sample farms in Punjab: 2004-05

(Rs/ ha)

	Sesamum	Paddy	Difference
Human labour	2164	4330	-2166**
Machine labour	1832	4787	-2955**
Seeds	97	106	-9*
Fertilizer/Farmyard manure	-	1845	-1845
Herbicides	-	416	-416
Insecticides/ pesticides	236	1229	-993**
Irrigation	70	3943	-3873**
Interest on variable cost @10 %	110	423	-313
Miscellaneous expenses	8	276	-268
Total variable cost	4517	17357	-12840**
Yield -Main product, q/ha	3.95	56.76	
Price -Main product, Rs/q	1443.5	580.0	
Value of main product, Rs/ha	5702	32923	-27221**
Value of by-products, Rs/ha	468	-	468
Gross income, Rs/ha	6170	32924	-26754**
Return over variable cost, Rs/ha	1653	15567	-13914**
Benefit-cost ratio	1.36	1.90	-0.54

Note: ** ,* indicate significance at 1 per cent and 5 per cent levels, respectively.

were 0.009 and 0.74, respectively which were significant at 5 per cent level, and indicated that an increase of one per cent in expenditure on plant protection measures and human labour led to an increase in the yield value of sesamum crop by 0.009 and 0.74 per cent, respectively. The coefficient of education of the decision-maker (0.005) was positive and significant at 5 per cent level, indicating that education plays a vital role in increasing the yield of sesamum. The coefficients of expenditure on seed and machine labour were 0.13 and 0.50, respectively and these came out to be non-significant. Similarly, the coefficients of area under sesamum crop and irrigation were found to be positive, but non-significant.

Large Farms: The coefficients of multiple determinations were found to be 0.98 on large farms, and 0.93 on small farms, showing that sesamum yield depended largely on the changes in the variables included in the model. The coefficients of expenditure on human labour and plant protection measures were positive and highly significant, contributing towards increase in yield value of sesamum crop. Thus, with one per cent increase in expenditure on human labour and plant protection measures, the resultant value of sesamum yield increased by 1.63 and 0.006 per cent, respectively. The coefficients of education of decision-maker, area under sesamum crop

Table 4. Regression coefficients of Cobb-Douglas type functions for sesamum crop on sample farms in Punjab: 2004-05

Particulars	Small farms	Large farms	All farms
Intercept	-1.32	-3.98	-2.72
Education	0.005 *	0.001	0.004 *
(years of schooling)	(0.002)	(0.001)	(0.001)
Area under sesamum (ha)	0.04	0.02	0.03
	(0.04)	(0.01)	(0.02)
Cost on seed (Rs)	0.13	-0.10	-0.01
	(0.19)	(0.09)	(0.11)
Cost on plant protection	0.009 *	0.006 **	0.007 **
measures (Rs)	(0.003)	(0.001)	(0.002)
Irrigation (No.)	0.10	-0.09	0.004
	(0.09)	(0.05)	(0.05)
Cost on human labour (Rs)	0.74 *	1.62 **	1.09 **
	(0.26)	(0.14)	(0.16)
Cost on machine labour (Rs)	0.50	0.08	0.40
	(0.57)	(0.12)	(0.21)
Coefficient of multiple determination (R^2)	0.93	0.98	0.93
Adjusted coefficient of multiple determination (R^2)	0.91	0.98	0.92

Figures within the parentheses are standard errors of regression coefficients
Note: **,* indicate significance at 1 per cent and 5 per cent levels, respectively.

and machine labour were 0.001, 0.02 and 0.08, respectively, which were found to be non-significant. The coefficients of seed and irrigation came out to be negative and non-significant.

Overall: On the whole, the value of coefficient of multiple determinations was found to be 0.93, indicating that yield of sesamum was intimately related with the costs on various inputs included in the model. The coefficients of human labour and plant protection measures were 1.09 and 0.007, respectively, which were highly significant, implying that with one per cent increase in expenses on these variables, the resultant yield value of sesamum increased by 1.09 per cent and 0.007 per cent, respectively. The coefficient of education of the decision-maker was 0.004, which was significant at 5 per cent level. Thus, education played a significant role in increasing the sesamum yield. The coefficients of area under sesamum crop, irrigation and machine labour were observed to be positive, though non-significant. However, the coefficient of expenditure on seed was negative and non-significant.

From the comparative picture it was seen that expenditures on human labour and plant protection measures were the major factors contributing

towards increase in sesamum yield on both farm-size categories. Also, education of the decision-maker played a significant role in increasing the yield of sesamum crop.

(iv) Resource-use Efficiency of Sesamum

The resource-use efficiency judged on the basis of marginal value productivity of the selected variables for sesamum crop on sample farms in Punjab has been depicted in Table 5.

Small Farms: The coefficients for human labour and plant protection measures, respectively were 1.93 and 0.26, statistically significant. The coefficient of human labour indicated that expenditure of one additional rupee on human labour would add about Rs 1.93 to the value productivity of sesamum crop. On the contrary, one rupee spent on plant protection measures, added only Re 0.26 to the returns, showing that this input was being used beyond the optimal point. The coefficients of remaining inputs like seed and machine labour were found to be non-significant.

Large Farms: The coefficients for human labour and plant protection measures, respectively were 4.30 and 0.13, and were statistically significant. The coefficient of human labour indicated that expenditure of one additional rupee on human labour would add about Rs 4.30 to the value productivity of sesamum crop, whereas additional one rupee spent on plant protection measures would add only Re 0.13 to the returns, showing that this input was being used beyond the optimal point. The coefficients of remaining inputs like seed and machine labour were found to be non-significant.

Overall: In case of both small and large farms, the coefficients for human labour and plant protection measures were found to be statistically significant. The coefficient of human labour showed that additional one rupee spent on human labour would add about Rs 2.86 to the value productivity of seasmum crop. On the other hand, one rupee spent on plant protection measures would add only Re 0.17 to the returns, showing that this input was being

Table 5. Marginal value productivities of different inputs in sesamum cultivation on sample farms in Punjab: 2004-05

Particulars	Small farms	Large farms	All farms
Seed	6.26	-5.04	-0.32
Plant protection measures	0.26 *	0.13 **	0.17**
Human labour	1.93 *	4.30 **	2.86**
Machine labour	1.48	0.26	1.26

Note: **,* indicate significance at 1 per cent and 5 per cent levels, respectively.

used beyond the optimal point. The coefficients of remaining inputs like seed and machine labour were found to be non-significant.

In a comparative situation, it was seen that there is scope of increasing yield value of sesamum crop by employing more human labour for plant protection measures. Hence, it can be inferred that spending more on plant protection measures, human labour for pesticide spray would be worth to further enhance the value productivity of the sesamum crop on all farm-sizes.

(v) Constraint Analysis

The constraints faced by sesamum growers like biotic (diseases, inset/ pest and weeds) and abiotic such as input availability constraints (seeds, 'irrigation, fertilizers, insecticides, pesticides, labour, machinery, credits), environmental constraints (drought, rain, temperature, frost) and marketing constraints (information related to price and its variability, storage losses, cost on transport, etc.) were studied.

Biotic Constraints

Diseases: Main diseases as perceived by farmers have been recorded in Table 6. The phyllody and blight were the major diseases infecting the sesamum crop. Yield losses due to these diseases were 2.84 and 0.90 per cent, respectively. However, the intensity of phyllody was more than of blight. About 38 per cent farmers reported moderate, 16 per cent as severe and 6 per cent as very severe intensity of phyllody. In the case of blight, moderate attack was reported by 22 per cent farmers (Table 7).

Insect/pest: Insect/pest attack was another reason of yield loss (Table 6.). The jassid and sesamum leaf webber and capsule borer were the major enemies of sesamum crop. The yield losses due to these insects were 3.90 and 2.56, per cent, respectively. The intensity of these insects varied from slight to severe. Nearly 32 per cent farmers reported moderate, 16 per cent severe and 6 per cent very severe attack of jassid on the sample farms (Table 7). Attack of sesamum leaf webber and capsule borer was reported as moderate by 36 per cent farmers and by 12 per cent farmers as severe.

Weeds: Weeds intensity was another problem in sesamum production (Table 6). Various weeds found in sesamum crop were Itsit (*Trianthema portubacastrum*), Madhana (*Elusine spp*.), Bhakhra (*Triloulus terristris*), Motha (*Cyperus rotundus*) and Grass (*Cynadon dactylon*). The major yield loss was due to Itsit (*Trianthema portubacastrum*) (2.58 per cent) and Motha (*Cyperus rotundus*) (0.96 per cent). The intensity of Itsit was reported as moderate by 28 per cent farmers, as severe and very severe by

Table 6. Biotic and abiotic constraints faced by sesamum growers on the sample farms in Punjab: 2004-05

Biotic constraints	Yield loss, %
Disease	
Phyllody	2.84
Blight	0.90
Insect/ pest	
Jassid	3.90
Sesamum leaf webber & capsule borer	2.56
Weeds	
Itsit *(Trianthema portulacastrum)*	2.58
Madhana *(Elusine spp.)*	0.46
Bhakra *(Triloulus terristris)*	0.14
Motha *(Cyprus rotundas)*	0.96
Grass *(Cynadon dactylon)*	0.12
Abiotic constraints	
Environmental constraints	
Drought	2.18
Rain	1.24
High temperature	0.18
Seed shattering	0.76
Input constraints	**Per cent farmers**
Irrigation	64.0
Shortage of labour	34.0
Marketing constraints	
Price variability	40.0
Lack of price information	24.0

14 per cent farmers (Table 7). In other weeds, the intensity varied from slight to moderate.

Abiotic Constraints

Environmental Constraints: The yield losses in seasamum production due to various environmental constraints reported in Table 6 were 2.18 per cent, 1.24 per cent and 0.76 per cent by drought, rain and seed shattering, respectively. The intensity of these constraints varied from moderate to severe. The intensity of drought was perceived as moderate by 40 per cent farmers and as severe by 14 per cent farmers. Nearly 16 per cent farmers reported intensity of rain as moderate and 12 per cent farmers reported seed shattering as the moderate to severe constraint (Table 7).

Input Constraints: The problem of irrigation and shortage of labour were the major problems being faced by sesamum growers. The irrigation problem

Table 7. Intensity of biotic and abiotic constraints faced by sesamum growers on the sample farms in Punjab: 2004-05

(Per cent of farmers)

Constraints	No occur-rence	Occur-rence but no loss	Slight problem	Mode-rate problem	Severe problem	Very severe problem
Biotic constraints						
Disease						
Phyllody	12	4	24	38	16	6
Blight	44	20	14	22	0	0
Insect/ pest						
Jassid	8	8	30	32	16	6
Sesamum leaf webber & capsule borer	20	6	26	36	12	0
Weeds						
Itsit *(Trianthema portulacastrum)*	12	18	28	28	12	2
Madhana *(Elusine spp.)*	22	20	36	22	0	0
Bhakra *(Triloulus terristris)*	42	24	22	12	0	0
Motha *(Cyprus rotundas)*	10	26	36	24	4	0
Grass *(Cynadon dactylon)*	12	36	32	20	0	0
Abiotic constraints						
Environmental constraints						
Drought	6	8	32	40	12	2
Rain	26	22	36	16	0	0
High temperature	20	32	38	10	0	0
Seed shattering	24	28	36	12	0	0
Input constraints						
Irrigation	16	6	14	32	24	8
Quality seeds	46	22	26	6	0	0
Fertilizers	84	12	4	0	0	0
Insecticides/ pesticides	78	8	14	0	0	0
Shortage of labour	20	8	38	26	8	0
Machinery	76	12	8	4	0	0
Credit	72	20	8	0	0	0
Marketing constraints						
Lack of price information	28	18	30	20	4	0
Price variability	22	12	26	32	8	0
Storage losses	42	20	28	10	0	0
High labour needs	34	26	32	8	0	0
Transport	76	10	12	2	0	0
Low market demand	54	28	18	0	0	0

was reported as moderate by 32 per cent farmers, as severe by 24 per cent and as very severe by 8 per cent farmers. The shortage of labour was perceived by nearly 26 per cent farmers as moderate and by only 8 per cent farmers as severe. The availability of fertilizers, insecticides/pesticides, machinery and credit was not a serious problem on the sample farms.

Marketing Constraints: Major marketing constraints highlighted by the sesamum growers (Table 7) were price variability and lack of price information. Price variability was reported by 32 per cent farmers as moderate and by 8 per cent as severe. Lack of price information was reported by 20 per cent farmers as moderate and by 4 per cent as severe. Constraints like labour, storage , transport and low market demand were not considered as the major problems by these farmers.

Conclusions and Policy Options

It has been found that sesamum provides lower returns in terms of gross returns as well as returns over variable cost as compared to its major competing crop, paddy. The overall state average productivity of the sesamum crop has been found almost stagnant over the years, reflecting inadequacy of research efforts for the upliftment of sesamum in the state. The regression analysis has brought out that there exists sufficient potential in spending on plant protection measures, and human labour for pesticide spray to further enhance the value productivity of sesamum crop in the state. Hence, two-dimensional efforts, viz. technological upgradation and effective market support are urgently required to make sesamum production a remunerative enterprise.

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