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Resource Use and Economic Potential of Chickpea Cultivation in Haryana, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted in Bhiwani, Dadri and Mahendragarh districts of Haryana during the year 2021-22. Budgeting technique was employed to draw practical implications and production function was used for measure the extent of resource use in chickpea cultivation for taking policy decisions to encourage its cultivation in Haryana. The Negative growth rates of area and production of chickpea was observed in Haryana during last two decades (2000-01 to 2020-21). In same period owing large replacement of area towards mustard and wheat. The gross and net returns of Chickpea cultivation in Haryana worked out were Rs. 75842 ha^{-1} andRs. 21550 $ha^{-1.}$ The value of B:C ratio was 1.40 over total cost. The Marginal value productivity (MVP) Value of Chemical fertilizer, plant protection chemicals, machinery and irrigation was greater than unity for Bhiwani, Dadri, Mahendragarh and Haryana which indicates that these inputs were underutilized in the respective districts and Haryana. On the other side, the value of MVP were less than unity for

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Human Labour and seed in all districts indicating that these resources were over utilized, needs to be curtailed for higher returns. The major Constraints faced by Chickpea growers were unavailability of improved varieties in local market (85.83%), Price realization less than M.S.P./underpricing their produce (80.83%), Non-adoption of package of practice/ low input used (75.83%) and high incidence of insect-pest (64.17%).

Keywords: CAGR; economic potential; resource use efficiency; constraints; chickpea.

1. INTRODUCTION

India is a premier pulse growing country. Chickpea cultivation in the world in mainly confined to India, Australia, Turkey, Myanmar, Pakistan and Ethiopia account for about 90 percent of the world chickpea production. Chickpea is a king of pulse consists of more than 1/3rd of area and 40 percent of the total production of pulses in India. The area under cultivation of this crop in India was 9.996 million hectares with a production of 11.91 million tonnes during the year 2020-21(India stat. 2021). The major gram producing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka and Haryana. There is a shortage of pulses in the country as availability of pulses per capita is 45 gm/day against W.H.O. recommendation of 80 gm/day/capita.

Gram is main rabi pulse crop grown in South Western part of the Haryana. It accounted for nearly 80 per cent of total pulse area in the state. The area under cultivation of this crop in Haryana was 35690 hectare with a production of 35870 tonnes during the year 2020-21 (India stat. 2021).

Efficiency in food production largely depends upon extent of managing different resources. Hence the question of allocation of resources needs to consider sustainability, resource use efficiency and optimization of crop plans across regions and production environments [1-3].

Resource use efficiency in agriculture plays an important role in determining the farm production and income. Manures and fertilizers, irrigation facilities, manpower, seeds, hired human labour, working capital, farm implements and machinery and crop protection measures are the major crucial inputs in agriculture [4-7]. The size of farm income depends on the efficiency with which farmers are able to utilize these resources. With higher efficiency in the use of scare resources, farmers can augment their income and savings.

2. MATERIALS AND METHODS

The study was carried out during 2021-22 in three districts (Mahendragarh, Bhiwani and Charkhi-Dadri) from southern zone of Haryana. The purposive and random sampling techniques were used to select, villages and farmers. Further forty farmers were selected on random basis to extract relevant information pertaining to the extent of use of various Inputs. The prevailing market prices of purchased inputs, hired labour, imputed value of family labour were taken into account to work out economic viability of chickpea cultivation.

The Cobb-Douglas production function was used for estimating the resources used in Chickpea

$$Y= aX_1^{b_1} *X_2^{b_2} *X_3^{b_3} *X_4^{b_4} *X_5^{b_5} *X_6^{b_6}$$

Where,

Y = Dependent Variable (Gross income Rs./ha)
a = Constant
X_1 = Human labour (Rs./ha)
X_2 = Machinery (Rs/ha)
X_3 = Seed cost (Rs./ha)
X_4 = Fertilizer cost (Rs/ha)
X_5 = Irrigation cost (Rs./ha)
X_6 = Plant protection (in Rs/ha)

From the above production function the M.V.P. of each resource was worked out. The marginal value and productivity of particular input ‘’xi’ as geometric mean of input and output is expressed in following equation:-

$$MVPXi = bi\frac{\overline{Yi}}{\overline{Xi}}Pxi$$

Where,

MVP = Marginal Value Productivity
$\overline{Y}i$= Gross value of out- put (Rs.)
$\overline{Xi}$= Factor of production
bi= Regression coefficient of xi
Pxi= Price of xi

2.1 Trends and Growth

Trends and growth rates in area, production and productivity for studying the compound growth rates (C.G.R) in area, production, and productivity of Chickpea for the Haryana and India were calculated for the period of 21 years *i.e.* 2000-01 to 2020-21. The compounded growth rates were computed using exponential function of the form:

$$X_t = a\, b^t u_t$$

$$\text{Log } X_t = \text{Log } a + t \text{ Log } b + \text{Log } u_t$$

Where,

X_t = Area/production/productivity/of castor in year 't'
t = Time elements which take the value 1, 2, 3, 4,…..n
a = Intercept
b = Regression coefficient
u_t = Standard error term

Compound growth rates were worked out as follow:

Compound growth rate (r) = (b-1) x 100

The perception of identified farmers was recorded through interaction at field for various constraints inhibiting the cultivation of chick-pea. The responses of cultivation for production and marketing of chickpea were noted on three point continuum *i.e.* Very serious, serious and somewhat serious and subsequently assigned a weightage of 3, 2 and 1 respectively.

3. RESULTS AND DISCUSSION

In Haryana, the area under gram cultivation declined drastically over the period. The gram acreage came down sharply from 125 to 35.69 thousand hectares during 2000-01 to 2020-21. The compound annual growth rates of area (-1.57%), production (-1.37%) and yield (0.18%). This indicates that area from gram diverted towards more profitable crops like wheat and mustard due to low productivity, absence of promising or varieties, incidence of insect-pest and diseases whereas CAGRs of area (0.05%), production (0.03%) and yield (0.48%) of chickpea for country as a whole were found slight positive (Table 1).

Table 1. Compound annual growth rate of Chick-pea in Haryana and India

Years	Haryana			India		
	Area	Production	Yield	Area	Production	Yield
2000-01	125.00	80	640	5185	3855	744
2001-02	143.00	122	853	6416	5473	853
2002-03	55.00	41	745	5906	4237	717
2003-04	123.00	100	813	7048	5718	811
2004-05	107.00	91	850	6715	5469	815
2005-06	130.00	72	554	6926	5600	808
2006-07	108.00	91	843	7494	6334	845
2007-08	107.00	54	505	7544	5749	762
2008-09	123.00	128	1041	7893	7060	895
2009-10	84.00	62	738	8169	7476	915
2010-11	112.00	110	982	9186	8221	895
2011-12	79.00	72	911	8299	7702	928
2012-13	47.00	53	1128	8522	8833	1036
2013-14	83.00	75	904	9927	9526	960
2014-15	65.00	42	646	8251	7332	889
2015-16	42.00	26	619	8399	7058	840
2016-17	37.00	44	1189	9626	9377	974
2017-18	32.00	36	1125	10560	11379	1078
2018-19	44.90	62.19	1385	9547	9937	1041
2019-20	43.97	47.14	1072	9698	11078	1142
2020-21	35.69	35.87	1005	9995	11911	1192
CAGR (%)	-1.57	-1.37	0.18	0.05	0.03	0.48

Area (000 ha.), Production (000 tonnes), Productivity (kg/ha)

3.1 Cost and Returns of Chickpea Cultivation in Haryana

Harvesting was the major components of total variable expenses shared around 18.27 percent of the total cost in Bhiwani, 17.21 percent in Charkhi-Dadri and around 16.13 percent in MahenderGarh district of Haryana (Table 2). The highest component of total expenses incurred in cultivation of Chick-pea in Haryana were rental value of land with 31.63 per cent of total cost in Bhiwani, 35.34 per cent in Charkhi Dadri, and 33.41 percent in MahenderGarh district. The management and risk charges accounted for 6.46, 6.53 and 6.64 percent of total cost in Bhiwani, Charkhi Dadri and MahenderGarh, respectively. Plant protection cost ranges from 7.74 to 9.11 percent across all the districts, which is then followed by miscellaneous cost and transportation charges.

The average yield of chickpea cultivation in Bhiwani district was 12.75 q/ha main product with gross returns of ₹ 66403 and net returns of ₹ 18263 per hectare. In Charkhi-Dadri the yield is 14.75 q/ha with gross returns of ₹ 72593 and net returns of ₹ 18,609 per hectare. The average yield in MahenderGarh district is around 17.00 q/ha with a gross return ₹ 88530 and net returns of ₹ 27,777 per hectare, during 2021-22. The value of B: C ratio with ranges of 1.34 to 1.46 across districts indicates profitability of Chick-pea cultivation in the study area. The total cost of Chick-pea cultivation was estimated to be ₹54292 per hectare overall Haryana with district wise value of ₹ 48140, ₹ 53984 and ₹ 60753 per hectare in Bhiwani, Charkhi-Dadri and Mahendragarh, respectively.

As shown in Table 3 the values of coefficient of multiple determinations (R^2) were found to be quite high in all the three selected districts (63.44 to 81.85%) which indicated that the selected form of the production function was best fitted. The marginal value productivity of various inputs and their ratio to their respective prices for Bhiwani, Dadri, Mahendragarh districts and overall were found that fertilizer (3.57, 1.57, 3.69 & 1.24), plant protection (1.46, 1.25, 2.19 & 2.92), machinery (1.76, 1.78, 1.62 & 1.90) and irrigation (1.41, 1.54, 1.57 & 1.33) were found to be underutilized on sample farm, respectively. The MVP for Bhiwani, Dadri, Mahendragarh districts and overall for human labour (0.89, 0.04, -0.33 & 0.37) and seed cost (-0.43, -0.46, -2.42 & 0.77) were less than the unit price of respective inputs, respectively and implying over utilization of these inputs and leaving scope for their efficient use. Similar findings were also observed by Thakur et al. [8].

Table 2. Cost and returns of Chick-pea cultivation in Bhiwani, Charkhi-Dadri and Mahendergarh districts of Haryana

Sr. No.	Item	Bhiwani	Charkhi-Dadri	Mahendergarh	Overall
A. Variable cost					
1	Field Preparation and sowing	6205	6775	8625	7202
		(12.89)	(12.55)	(14.20)	(13.27)
2	Seed	3753	3613	4120	3829
		(7.80)	(6.70)	(6.78)	(7.05)
3	Fertilizer investment	1593	2173	2233	2000
		(3.31)	(4.02)	(3.68)	(3.68)
4	Irrigation	2468	1895	4325	2896
		(5.13)	(3.51)	(7.12)	(5.33)
5	Plant Protection	4385	5050	4700	4712
		(9.11)	(9.35)	(7.74)	(8.68)
6	Harvesting and threshing	8795	9290	9800	9295
		(18.27)	(17.21)	(16.13)	(17.12)
7	Int. & Miscellaneous	1230	1335	1415	1327
		(2.56)	(2.47)	(2.33)	(2.44)
8	Total Variable cost	28429	30131	35218	31259
		(59.05)	(55.81)	(57.97)	(57.58)
B. Fixed cost					
9	Management and risk charges	3108	3525	4035	3556
		(6.46)	(6.53)	(6.64)	(6.55)
10	Rental value of land	15228	19078	20300	18202
		(31.63)	(35.34)	(33.41)	(33.53)
11	Transportation charge	1375	1250	1200	1275

Sr. No.	Item	Bhiwani	Charkhi-Dadri	Mahendergarh	Overall
		(2.86)	(2.32)	(1.98)	(2.35)
12	Total fixed cost	19711	23853	25535	23033
		(40.95)	(44.19)	(42.03)	(42.42)
C. Total cost (A+B)		48140	53984	60753	54292
		(100.00)	(100.00)	(100.00)	(100.00)
D. Returns structure					
13	(a) Main product	62988	69658	83980	72209
		(12.75)*	(14.75)*	(17.00)*	(14.83)*
	(b) By-product	3415	2935	4550	3633
14	Gross return	66403	72593	88530	75842
15	ROVC	37974	42462	53312	44583
16	Net returns	18263	18609	27777	21550
17	B:C (ROVC)	2.34	2.41	2.51	2.42
18	B:C (TC)	1.38	1.34	1.46	1.40

*Note- Figure in parenthesis indicates the percentage to total cost, *Figures in brackets denote yield in terms of quintals*

Table 3. Resource use efficiency of chickpea in Haryana

Particulars	Bhiwani				
	GM	**b**	**MVP**	**MFC**	**MVP/MFC**
Intercept	3.8118				
Human Labour (Rs/ha)	26603.08	0.36	0.89	1.00	0.89
Machinery (Rs/ha)	7899.10	-0.21	-1.76	1.00	1.76
Seed Cost (Rs/ha)	3719.18	-0.02	-0.43	1.00	-0.43
Fertilizer cost (Rs/ha)	1959.73	-0.11	-3.57	1.00	3.57
Irrigation cost (Rs/ha)	3829.96	0.08	1.41	1.00	1.41
Plant Protection (Rs/ha)	4822.02	0.11	1.46	1.00	1.46
R^2	**0.7646**				
	Charkhi-Dadri				
Intercept	4.5092				
Human Labour (Rs/ha)	27500.97	0.01	0.04	1.00	0.04
Machinery (Rs/ha)	8046.10	0.16	1.78	1.00	1.78
Seed Cost (Rs/ha)	3817.41	-0.02	-0.46	1.00	-0.46
Fertilizer cost (Rs/ha)	1993.00	-0.01	-0.57	1.00	1.57
Irrigation cost (Rs/ha)	4141.30	-0.07	-1.54	1.00	1.54
Plant Protection (Rs/ha)	5216.21	0.03	0.57	1.00	1.25
R^2	**0.8185**				
	Mahendragarh				
Intercept	6.0718				
Human Labour (Rs/ha)	23844.75	-0.10	-0.33	1.00	-0.33
Machinery (Rs/ha)	7899.10	-0.06	-0.62	1.00	1.62
Seed Cost (Rs/ha)	3719.18	-0.11	-2.42	1.00	-2.42
Fertilizer cost (Rs/ha)	1959.73	0.09	3.69	1.00	3.69
Irrigation cost (Rs/ha)	3829.96	0.03	0.57	1.00	1.57
Plant Protection (Rs/ha)	4822.02	-0.13	-2.19	1.00	2.19
R^2	**0.6344**				
	Overall				
Intercept	10.4318				
Human Labour (Rs/ha)	27048.30	1.89	5.37	1.00	0.37
Machinery(Rs/ha)	7972.26	-0.82	-7.90	1.00	1.90
Seed Cost (Rs/ha)	3767.97	1.51	30.77	1.00	0.77
Fertilizer cost (Rs/ha)	1976.29	-0.03	-1.24	1.00	1.24
Irrigation cost (Rs/ha)	3982.59	0.69	13.33	1.00	1.33
Plant Protection (Rs/ha)	5015.25	0.65	9.92	1.00	2.92
R^2	**0.6830**				

Table 4. Constraints faced by farmers in the production and marketing of Chick-pea in Haryana

Sr. No	Constraints	Total	Percentage	Farmer's Ranking
1	Less availability of improved varieties of seeds in local markets	103	85.83	I
2	Price realization less than M.S.P/ Under-pricing their produce	97	80.83	II
3	Non-adoption of package of practice/low input used	91	75.83	III
4	High incidence of insect pest and disease	77	64.17	IV

The various constraints faced by the growers in production and marketing of chickpea in the selected districts of Haryana is shown in Table 4. The results revealed that unavailability of improved seed in local market is the major constraint faced by the farmers which is followed by under-pricing their produce, then followed by low input use and high incidence of insect pest. Similar results were also reported by Singh et al., [9].

4. CONCLUSIONS

In Haryana, the area under gram cultivation declined drastically over the period. The gram acreage came down sharply from 125 to 35.69 thousand hectares during 2000-01 to 2020-21. The Compound annual growth rates of area (-1.57%), production (-1.37%) and yield (0.18%). This indicates that area from gram diverted towards more profitable crops like wheat and mustard due to low productivity, absence of promising varieties, incidence of insect-pest and diseases. The net returns (₹ 18,263, ₹ 18,609 and ₹ 27,777 per ha for Chick-pea in Bhiwani, Dadri and Mahendragarh districts and benefit cost ratio (>1) in all districts revealed that Chick-pea cultivation is a profitable and promising enterprise in selected districts. The regression analysis has brought out that ratio of MVP/MFC is (>1) indicates that there exist sufficient potential in spending on fertilizer and plant protection measures. The major constraints faced by farmers were Less availability of improved varieties of seeds in local markets (85.83%) and less price realisation (80.83%).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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