RESEARCH ARTICLE

ECONOMIC ANALYSIS OF COST –NET RETURN AND COST BENEFIT RATION OF ONION IN RAJASTHAN

Vishnu Shankar Meena[1], Shirish Sharma[2], Rahul Kumar[3]*, Sweta Singh[4], N.C. Pant[5], R.K. Meena[6], D.K. Meena[7] and N.K. Barod[8]

[1,3,4,5,6,7,8]COA, Bharatpur, SKN Agriculture University, Jobner, Rajasthan
[2]SK Rajasthan Agricultural University, Bikaner,Rajasthan
Email: vishnurau@gmail.com

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Abstract: Onion is a multi-faced crop; it brings cheers to traders, fear to farmers and tears to consumers. Growing onion demands a set of learnt practices to establish crop. Amongst the states, comparatively farmers of southern states are well equipped with the knowledge base of production practices than the northern plain zone. Problems/ constraints are the challenges that pose threat to production, mostly uncertain. Costs are key driver to ascertain in net farm income. It looks quite small on an individual basis but at aggregate level they add up to total cost. In spite of the fact that onion farming incurs huge cost, the net income from onion cultivation is fairly well in all the states except during the time when there is a glut in market. Onion is an important vegetable crop. There is no kitchen in the world without onion. Taking this into account the study aims to assess and quantify the yield gaps, which is vital in determining the reason less returns, apart from price fluctuation. Much of the yield gap was evidenced in the states with highest production. This uneven production due to wider yield gap directly impacted on the wholesale and retail prices of onion.Thus, the study has been taken within the demarcated objectives and the elucidation of data from the respondents inRajasthan. The policy measures thus, concluded are recommended based on the facts evidenced from the study.

Keywords: Onion, Cost, Yield, Economics, BC ratio

INTRODUCTION

Onion (*Allium cepa* L.) has about 500 species of herbs, occurring throughout the northern hemisphere, with the greatest number in the USSR (Wright, 1992). Onions, compared with other fresh vegetables, are relatively high in food value, intermediate in protein content and are rich in calcium and riboflavin (Purse glove *et al*., 2000). Onion is not known with certainty as a wild plant. It is believed to have originated in an area which includes Iran, West Pakistan and the mountainous countries to the North (Purse glove *et-al*, 2000). In India, onion is one of the most important commercial vegetable crops cultivated extensively not just for their broad culinary uses, but also because their price swings can influence political outcomes. It belongs to the family Alliaceae. India is the world's second-largest producer of onion, after China. A global review of area and production of major vegetables shows that the world production is 75977209 million tonnes from an area of 3971505 hectares. India ranks third in export after Netherland and Spain (Horticulture Statistics, 2016). India accounts for 19.90 per cent of the world production and ranks first in total area under onion cultivation. Onion is an important crop in all the continents and is commercially cultivated in various countries. It is a crucial item in every kitchen as vegetable and condiment in India. In India it is being grown in an area of 1305.62 thousand hectares with a production of 22427.42 thousand million tones and the productivity is 17.18 tons per hectare. The major onion producing states in the country are Maharashtra, Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan, Haryana, Uttar Pradesh and Tamil Nadu. These states together account about 87.93 per cent of the total area and 89.91 per cent of the total production of onion in the country (Anonymous, 2010). Onion in the country is planted in three season"s viz., kharif, late kharif and rabi with 20, 20 and 60% proportion, respectively. The principal onion growing districts in Rajasthan state are Sikar, Alwar, Bharatpur, Jaipur, Tonk, Kota, Nagore etc. Sikar accounts for the bulk of the total onion production.

Rationale of the study

Although it is widely believed that the marketing of fruits and vegetables is a complex process due to their perishability, fragility, seasonality and bulkiness, it is expected that measures and programme initiatives such as adoption of improved pre and post-harvest technology and water and pest control practices will not only increase the productivity of individual horticultural crops and their quality, but these are also likely to substantially minimize the post-harvest losses, increase the total crop area cover and generate adequate quality surplus for their conversion into value-added food products. Owing to inelastic demand and seasonal production of onion, the prices for onion are not stable throughout the year. Price fluctuation creates uncertainty in the income levels of onion growers and price paid by the consumer. The low share of producer's in the consumer's rupees, particularly during high production and arrival period has been a

*Corresponding Author

matter of serious concern for policy makers in India. An understanding of price fluctuations is a pre-requisite for stabilization programme. It gives some idea to the government procurement agency regarding the suitable time for making purchases. To farmers, it is helpful in providing guidance as to when and where it will be more profitable for them to dispose off their produce. In the past, various attempts have been made to investigate the behaviour of price and arrivals and its relationship in vegetables like potato, tomato, brinjal, chillies, etc [Shiskin (1958), Acharya and Agarwal (1994), Gupta (1997), Singh *et al*., (1993), Jha (1971), Gupta (1970), Kainth and Mehra (1988), Sidhu and Chahal (1988), Parthasarathy*et al.,* (1988), Agarwal and Dhaka (1998), Goswami (1991)]. Most of the studies in the onion marketing are limited to the identifying various marketing channels and measurement of their efficiencies [Thakur and singh (1971), Neelakantaiah (1995), Shah (1999), Pajankar*et al*.,*(*2000), Gadre et al (2002)], Meena et al. 2020. Therefore, the above study was undertaken in Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Bihar, Andhra Pradesh, Haryana, Telangana, Rajasthan and Uttar Pradesh with the following objectives.

Objectives

- To study the personal and socio-economic characteristics, knowledge level and adoption behaviour of recommended cultivation practices by onion growers,
- To analysis the cost, returns and yield gap of onion cultivation of sample farmers,
- To ascertain the problems experienced by the onion growers and their suggestions.

Data Base and Methodology

To analyse various objectives of the study, an appropriate methodology describing sampling design, data collection and tools of analysis for conducting the study is important.Rajasthan state based on substantial area and production under onion crop was selected for the present study. The primary data collection survey was conducted to know socio-economic characteristics of onion growers, knowledge and adoption behaviour of recommended cultivation practices, problems experienced by the onion growers of the study area. Primary as well as secondary data were used for the study. Primary data were collected on pre-structured schedules. The pre-testing of the schedule was done by collection of data from few farmers through personal interview method. All the data sets were analysed by using statistical package for social science (SPSS) computer software, which facilitated the generation of descriptive statistics using frequency and percentage.

METHODOLOGY AND ANALYTICAL TECHNIQUES

The data collected for the purpose of the study were quantified, categorized and tabulated. The statistical tools such as mean, standard deviation, frequency, percentage and correlation coefficient were employed to draw valid conclusions.

Mean: The arithmetic mean is the sum of the scores divided by their number. This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Frequency: This measure was used to know the distribution pattern of responses of respondent's to categorize the problems perceived by onion growers in order of importance.

Percentage: This measure was used for simple comparisons.

Standard deviation: This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Karl Pearson's Correlation Coefficient (r): Karl Pearson's Correlation Coefficient (r) was computed in order to know the nature of relationship between the dependent and independent variables. The values of the correlation coefficients worked out as per the fallowing formula.

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

Where,

r = correlation coefficient between variables X and Y

X = sum of scores of variable X

ΣY = sum of scores of variable Y

ΣY = sum of products of variable X and variable Y

ΣX^2 =sum of squares of X variable

ΣY^2 = sum of squares of Y variable

n = paired number of observations

Cost and returns of onion production

In the present study, the economics of onion cultivation was arrived at by computing per ha cost and returns structure. Total operational cost was worked out. The gross returns, net returns and benefit cost ratio was calculated by using the formula,

$$\text{B:C Ratio} = \frac{\text{Gross return (₹/ha)}}{\text{Total operational cost (₹/ha)}}$$

Gross returns (₹) = Actual per ha yield (q) of onion x market price (₹/q)

Net returns (₹) = Gross returns (₹)/ha-total operational cost/ha

Description of study domain and demographic profile

This section mainly deals with the socio-economic profile of sampled farmers drawn from the selected state since the socioeconomic characteristics of farmers have a profound influence on the decision making process and profitability of crop enterprise. The information relating to age, education status, land holding, and farming experience has been

analysed and discussed for various categories of sampled farmers of selected districts. The knowledge of the background of the sampled farmers is essential since the viability of any enterprise heavily depends on the favourable attitudinal changes towards adoption of superior technical inputs or technique of production, which in turn, depends on technical skills and resource position of the farmers. Apart from providing general background information of the sampled farmers, this section also provides a general overview of the onion grower population.

RESULTS AND DISCUSSION

The present study relies on the data collected from 1212 sample farmers selected from four different districts of Rajasthan viz., Sikar (403), Alwar (277), Bharatpur (277) and Jaipur (255). The personal and socio-economic characteristics of farmers (Table 1) reveals that, majority of the onion farmers (40 to 50 %) belong to middle age group (33 to 60 years) in all the four selected districts. This is in accordance with the findings of Peter *et.al*, (1996), that 45 per cent of the respondents were within the active age of 30 to 55 years. Age directly affects the year of experience of farming (all other things being equal), which was shown in Table 1. Farmers at this age are physically strong and capable of making good production decisions and have potential for greater productivity, hence are more efficient in agricultural production than older farmers.

This study reveals that most of the respondents were well experienced in onion farming. The operational land holding of the respondents was the size of the land owned and cultivated by them. The table depicts that majority of the onion growers are marginal farmers (61 to 65 %) followed by the small farmers (25 to 30 %) and medium farmers (6 to 10 %). Regarding the educational attainment, a major proportion (about 30 %) of the farmers has primary education, whereas around 25 per cent of the farmers were illiterates. The proportion of graduate farmers were highest in Sikar (15.88 %), followed by Bharatpur (13.72 %), Alwar (11.55 %) and Jaipur (5.49 %) and only 3 to 6 per cent farmers of the selected districts have completed their post-graduation.

Table 1. Distribution of respondents according to their personal and socio-economic Characteristics

S.No.	Category	Sikar (N=403)	Alwar (N=277)	Bharatpur (N=277)	Jaipur (N=255)
A	**(Age)**				
1.	Young (<33)	127 (31.51)	86 (31.05)	75 (27.08)	60 (23.53)
2.	Middle (33 to 60)	198 (49.13)	112 (40.43)	114 (41.16)	122 (47.84)
3.	Old (>60)	78 (19.35)	79 (28.53)	88 (31.77)	73 (28.63)
B	**Education level**				
1.	Illiterate	92 (22.83)	74 (26.71)	68 (24.55)	61 (23.92)
2.	Primary	114 (28.29)	80 (28.88)	78 (28.16)	88 (34.51)
3.	High school	110 (27.30)	79 (28.52)	75 (27.08)	84 (17.1)
4.	Graduate	64 (15.88)	32 (11.55)	38 (13.72)	14 (5.49)
5.	Post Graduate	23 (5.71)	12 (4.33)	18 (6.50)	8 (3.14)
C	**Land holding**				
1.	Marginal(up to 1 ha)	258 (64.02)	170 (61.37)	174 (62.82)	168 (65.88)
2.	Small (1 to 2 ha)	101 (25.06)	81 (29.24)	78 (28.16)	68 (26.67)
3.	Medium (2 to 4 ha)	37 (9.18)	22 (7.94)	18 (6.50)	17 (6.67)

4.	Large (> 4 ha)	7 (1.74)	4 (1.44)	7 (2.53)	2 (0.78)
D	**Farming experience**				
1.	Low	98 (24.32)	70 (25.27)	67 (24.19)	81 (31.76)
2.	Medium	247 (61.29)	128 (46.21)	134 (48.38)	127 (49.80)
3.	High	58 (14.39)	79 (28.52)	76 (27.4)	47 (18.43)

Knowledge level of onion farmers

In the present study, knowledge referred to the body of information understood and retained by the respondents about onion cultivation practices. It is evident from the data in Table 2 that, about 75 to 95 per cent farmers have knowledge about improved variety. In Sikar, 41 per cent farmers did not have this knowledge. This was also true in case of knowledge about the source of improved seed. The majority of farmers did not have enough knowledge about selection of varieties and balanced crop nutrition. Selection of varieties and balance crop nutrition are very important aspects operations to get higher yield.

Table 2. Cultivation practices knowledge level of onion farmers in selected districts.

Sr. No.	Practices	Sikar (N=403)		Alwar (N=277)		Bharatpur (N=277)		Jaipur (N=255)	
		No	Yes	No	Yes	No	Yes	No	Yes
1.	Improved variety	234 (58.06)	169 (41.94)	70 (25.27)	207 (74.73)	70 (25.27)	207 (74.73)	11 (4.31)	244 (95.69)
2.	Source of improved seed	266 (66.00)	137 (34.00)	70 (25.27)	207 (74.73)	70 (25.27)	207 (74.73)	75 (29.41)	180 (70.59)
3.	Selection of varieties	379 (94.04)	24 (5.96)	238 (85.92)	39 (14.08)	238 (85.92)	39 (14.08)	232 (90.98)	23 (9.02)
4.	Balance crop nutrition	383 (95.04)	20 (4.96)	198 (71.48)	79 (28.52)	275 (99.28)	2 (0.72)	22 (8.63)	233 (91.37)
5.	Recommended dose of fertilizer	220 (54.59)	183 (45.41)	154 (55.60)	123 (44.40)	80 (28.88)	197 (71.12)	90 (35.29)	165 (64.71)
6.	Fertilizer requirement	219 (54.34)	184 (45.66)	165 (59.57)	112 (40.43)	180 (64.98)	97 (35.02)	1 (0.39)	254 (99.61)
7.	Fertilizer scheduling in onion	216 (53.60)	187 (46.40)	170 (61.37)	107 (38.63)	158 (57.04)	119 (42.96)	1 (0.39)	254 (99.61)
8.	Pests & diseases and its control measure	183 (45.41)	220 (54.59)	70 (25.27)	207 (74.73)	170 (61.37)	107 (38.63)	2 (0.78)	253 (99.22)

Percentage figures are given in parentheses

Only in Jaipur district almost all the farmers have some knowledge about fertilizer dose, requirement and scheduling in onion. The table also revealed that nearly 55 per cent respondents in Sikar, 75 per cent in Alwar, 99 per cent in Jaipur and 39 per cent in Bharatpur had the knowledge of pests and diseases and their control measures.

Relationship between independent variables and level of knowledge in onion farming

The correlation coefficients of each of the personal and socio-economic characteristics with the knowledge level of onion growers have been presented in Table 3. It is revealed from Table 3 that, all the five independent variables, *viz.*, age, education, land holding, farming experience and scientific orientation showed significant relationship with the knowledge of onion growers, with education level having the correlation coefficient of 0.412, followed by farming experience (0.227) and Land holding (0.218).

Table 3. Relationships between independent variables and level of knowledge in onion farming

Independent Variable	Correlation coefficients (r)
Age	0.187**
Education level	0.412**
Land holding	0.218**
Farming experience	0.227**
Scientific orientation	0.198**

** Significant at 1% level

Adoption level of onion farmers in selected districts

A perusal of Table 4 shows adoption level of different onion cultivation practices by the farmers such as, improved varieties, soil testing and fertilizer use etc. Majority of the farmers in all the selected districts have neither adopted improved varieties nor used fertilizers. A very negligible proportion of farmers have adopted soil testing practices. Soil testing helps the farmers to reduce the cost of cultivation and to get higher income. It was very interesting that all the farmers have used tractors and other machineries for growing onion. Besides, it is clear that more than 90 per cent of the farmers have mechanized their farm, which was 100 per cent in case of Sikar. This reiterates the increasing scarcity of labour for timely sowing and the role of mechanization in farm operations including marketing has increased in agriculture. But a cattle rearing is considered as a remunerative enterprise and this could be of great importance in increasing the income of farmers.

Table 4. Cultivation practices adoption level of onion farmers in selected districts

Sr. No.	Practices	Sikar (N=403)		Alwar (N=277)		Bharatpur (N=277)		Jaipur (N=255)	
		No	Yes	No	Yes	No	Yes	No	Yes
1.	Improved varieties	255 (63.28)	148 (36.72)	253 (91.34)	24 (8.66)	253 (91.34)	24 (8.66)	225 (88.24)	30 (11.76)
2.	Soil testing	367 (91.07)	36 (8.93)	272 (98.19)	5 (1.81)	272 (98.19)	5 (1.81)	253 (99.22)	2 (0.78)
3.	Fertilizer use	329 (81.64)	74 (18.36)	273 (98.56)	4 (1.44)	273 (98.56)	4 (1.44)	200 (78.43)	55 (21.57)
4.	Mechanization	0.00	403 (100)	17 (6.14)	260 (93.86)	253 (91.34)	24 (8.66)	3 (1.18)	252 (98.82)
5.	Organic manure	2 (0.50)	401 (99.50)	10 (3.61)	267 (96.39)	10 (3.61)	267 (96.39)	5 (1.96)	250 (98.04)
6.	Bio fertilizers	263 (65.26)	140 (34.74)	243 (87.73)	34 (12.27)	245 (88.45)	32 (11.55)	93 (36.47)	162 (63.53)
7.	Micronutrient	390 (96.77)	13 (3.23)	272 (98.19)	5 (1.81)	262 (94.58)	15 (5.42)	88 (34.51)	167 (65.49)
8.	Water soluble fertilizer	371 (92.02)	32 (7.94)	247 (89.17)	30 (10.83)	227 (81.95)	50 (18.05)	78 (30.59)	177 (69.41)
9	Foliar application of WSF	387 (96.03)	16 (3.97)	248 (89.53)	29 (10.47)	258 (93.14)	19 (6.86)	148 (58.04)	107 (41.96)
10	Weedicide use	380 (94.29)	23 (5.71)	200 (72.20)	77 (27.80)	190 (68.59)	87 (31.41)	254 (99.61)	1 (0.39)

Percentage figures are given in parentheses.

Relationship of independent variables with the adoption behaviour of onion farmers

It is observed from Table 5 that level of education and land holding showed significant positive relationship (0.01 level of probability) with adoption behaviour of the respondents, whereas farming experience and scientific orientation exhibited significant positive relationship at 0.05 level of probability. On the other hand, age did not establish any significant relationship with the adoption level.

Table 5. Relationship of independent variables with adoption behaviour of onion farmers

Independent Variables	Correlation coefficient (r)
Age	0.021NS
Education level	0.217**
Land holding	0.283**
Farming Experience	0.118*
Scientific Orientation	0.164*

NS -Non-significant * Significant at 5% level of significance ** Significant at 1% level of significance

Extent of problems faced by respondents in improved cultivation practices of onion:

On farm problems:

Table 6 shows on-farm constraints in the selected districts of Rajasthan. The major on farm constraints are poor water quality, labour scarcity for cultural practices, non-availability of organic manure and non-availability of effective pest control measures as revealed by respondents. This may be due to poor technical knowledge on management aspects. Water quality is defined by certain physical, chemical and biological characteristics. The issue of water quality is a major problem in the study area that needs immediate attention by the government, NGOs and agencies, because agricultural sector is by far the biggest user of freshwater.

Table 6. On farm problems faced by respondents in improved cultivation practices of onion

Sr. No.	Practices	Sikar (N=403)		Alwar (N=277)		Bharatpur (N=277)		Jaipur (N=255)	
		No	Yes	No	Yes	No	Yes	No	Yes
1.	High cost/Poor quality of seeds	125 (31)	278 (69)	87 (31)	190 (69)	97 (35)	180 (65)	105 (41)	150 (59)
2.	Non-availability of fertilizer in time	113 (28)	290 (72)	92 (33)	185 (67)	110 (40)	167 (60)	98 (38)	157 (62)
3.	Insufficient water availability	211 (52)	192 (48)	129 (47)	148 (53)	129 (47)	148 (53)	10 (4)	245 (96)
4.	Poor water quality	12 (3)	391 (97)	8 (3)	269 (97)	0 (0)	277 (100)	0 (0)	255 (100)
5.	Lack of drip / sprinkler irrigation facility	365 (91)	38 (9)	279 (101)	4 (1)	273 (99)	4 (1)	66 (26)	189 (74)
6.	Labour scarcity for cultural practices	17 (4)	386 (96)	6 (2)	271 (98)	6 (2)	271 (98)	1 (0)	254 (100)
7.	Non-availability of organic manure	3 (1)	400 (99)	77 (28)	200 (72)	17 (6)	260 (94)	7 (3)	248 (97)
8.	Non-availability of Bio-fertilizers	1 (0)	402 (100)	47 (17)	230 (83)	60 (22)	217 (78)	26 (10)	229 (90)
9	Non-availability of effective pest control measures	8 (2)	395 (98)	15 (5)	262 (95)	27 (27)	250 (90)	254 (100)	1 (0)

10	Non-availability of effective disease control measures	31 (8)	372 (62)	19 (7)	258 (93)	57 (21)	220 (79)	1 (0)	254 (100)
11	Lack of knowledge about curing and drying of onion	257 (64)	146 (36)	152 (55)	125 (45)	147 (53)	130 (47)	114 (45)	141 (55)

Percentage figures are given in parentheses.

Off farm problems

The off-farm problems were related to marketing functionary, which was also as important as the production techniques in case of agricultural commodity. Unless and until marketing systems are improved, incentives to increase the production will not benefit the growers. The present study showed that shortage of storage facility was the major constraint for onion marketing as it is highly perishable in nature. A high fluctuation in market price was the second major problem followed by lack of awareness about crop insurance. Majority of the sample farmers faced the problem that, Government agencies like NAFED/MSAMB do not purchase onion regularly. The details of the off-farm problems with their values have been presented in table 7.

Table 7. Off farm problems faced by the respondents in improved cultivation practices of Onion

Sr. No.	Practices	Sikar (N=403)		Alwar (N=277)		Bharatpur (N=277)		Jaipur (N=255)	
		No	Yes	No	Yes	No	Yes	No	Yes
1.	Shortage of storage facilities	85 (21)	318 (79)	75 (27)	202 (73)	87 (31)	190 (69)	100 (39)	155 (61)
2.	High fluctuations in market price	44 (11)	359 (89)	54 (19)	223 (81)	78 (28)	199 (72)	35 (14)	220 (86)
3.	Govt agency like NAFED/MSAMB not purchasing onion regularly	76 (19)	327 (81)	65 (23)	212 (77)	70 (25)	207 (75)	42 (16)	213 (84)
4.	Lack of awareness about crop insurance	105 (26)	298 (74)	81 (29)	196 (71)	107 (39)	170 (61)	98 (38)	157 (62)

Percentage figures are given in parentheses.

Costs and returns

The knowledge of cost and return structure is essential to examine economic viability of the crop enterprise. Thus, this section evaluates the cost of production, and profitability analysis of onion cultivation in the selected districts of Rajasthan. Table 8 shows cost and return per hectare of onion produced in the study area, which reveals that the total cost of cultivation was ₹75016.00 per hectare. Furthermore, the cost of fertilizer was ₹ 14234.00 per hectare, ₹ 6192.00 for transplanting, ₹ 4322.00 for weeding and hoeing, and ₹ 7825.00 per hectare for harvesting. This could be due to labour intensive nature of the enterprise. The results indicated that land preparation and rising nursery were also cost intensive operations in growing onion.

Table 8. Costs and returns components for onion farming

S.No	Item	Cost and Returns (≠/ha)
1	Land preparation	4200.00
2	Seeds	7129.00
3	Nursery raising	1539.00
4	Manures	12000.00
5	Fertilizers	14234.00
6	Pesticides	6543.00

7	Irrigation	5600.00
8	Transplanting	6192.00
9	Weeding and hoeing	4322.00
10	Harvesting and curing	7825.00
11	Transportation and marketing cost	5432.00
12	Total cost of cultivation	75016.00
13	Production in q / ha.	213.60
14	Gross Return @₹ 600/q	128160.00
15	Net Return (₹/ha)	53144.00
16	Cost of production per q/ha.	351.20
17	Profit per quintal	248.80
18	Benefit cost Ratio	1.71

The average output per hectare of onion among the farmers in the study area was found to be 213.60 q/ha and the average price was ₹ 600 per quintal. The analysis shows that gross returns of ≠ 128160.00 were realized and net return was ₹ 53144.00 / ha. The net return per rupee invested was found to be 1.71. Hence, the cost and return analysis indicated that onion production in the study area was profitable. These findings are in conformity with the finding of Barakade and Lokhande (2011).

Yield gap analysis

In Rajasthan, there is a wide gap between productivity and yield potential of the improved onion technologies developed by various research institutes. The available agricultural technology does not serve the very purpose until it is successfully adopted by the farmers. Crop Cutting Experiment (CCE) is one of the important programmes to evaluate and demonstrate the production potential of the crop in the farmers' fields. The study was carried out during 2016 in four districts of Rajasthan state, namely, Sikar, Alwar, Bharatpur and Jaipur. All the Crop Cutting Experiment (CCE) was carried out in an average area of 0.38 ha in these districts. The improved technologies consisting of the use of improved variety, seed treatment, balanced fertilizer use, green manure application and integrated pest management. The yield data were collected from both the demonstrated and control plots (farmers' practices) by crop cutting experiment. CCE recorded higher yield as compared to farmers' practice yield. It was observed from the results of CCEs data with improved production technologies that there exists a wide yield gap in onion under real farm situations across the onion growing areas of Rajasthan. Analysis based on CCE data showed that the yield gap I was 46.47 per cent at the demonstration level (Table 9).

Table 9a. Yield gap analysis I

District	Area (ha)	No. of Demonstrations	Demonstration yield (q/ha)	Farmers practice yield (q/ha)	Yield gap (q/ha)
Sikar	0.40	36	219.85	209.07	10.78
Alwar	0.39	31	185.45	138.14	47.31
Bharatpur	0.23	27	249.75	153.71	96.04
Jaipur	0.51	40	190.78	157.00	33.78
Overall	0.38	134	211.45	164.48	46.97

The yield gap II was 34.29 per cent. This may be due to the adoption of improved variety by the resource endowed farmers of the state. Yield gap II has decreased by about 10 per cent. These results are in conformity with the findings of Hiremath*et al*. (2007) in other crops. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agriculture practices and local climatic conditions.

Table 9b. Yield gap analysis II

District	Area (ha)	No. of Demonstrations	Demonstration yield (q/ha)	Farmers practice yield (q/ha)	Yield gap (q/ha)
Sikar	0.39	36	224.82	210.24	14.58
Alwar	0.38	31	146.05	135.12	10.93
Bharatpur	0.23	27	251.83	153.71	98.12
Jaipur	0.51	40	191.71	178.15	13.56
Overall	0.37.	134	203.60	169.30	34.29

CONCLUSIONS AND POLICY IMPLICATIONS

The study was planned to analyse yield gap, constraint and performance of onion crop in the study area. The rationale, objectives and methodology of the study were described in detail in the first three sections followed by results and conclusion. In the results section, social and economic condition, constraints, cost of cultivation and yield gap were discussed. The primary data for the study were collected through quantitative survey and secondary data was assimilated from various published sources. The main findings are listed below:

a) In the study area farmers continue to use traditional farming methods thereby not been able to reap remunerative price of their crop (due to poor quality of produce). So it is suggested that Government and other agencies should provide technical backstopping along with the several capacity buildings on enhancing the produce, harvesting, and post-harvest handling of onion.

b) Adoption level of cultivation practice has immense potential in increasing the production and yield of the onion crop. It was found that farmers across the states out-performed in soil analysis, dueto soil health card scheme. Level of education has direct influence in adoption level of cultural practices, as the eastern and central states are poor in adoption. Hence there is a need of concerted effort from all the stakeholders to enhance adoption level and reduce yield gaps.

c) The results from the study inferred that, better transfer of technology in onion cultivation would enable the farmers in increasing their yields of onion.

d) Majority of sample farmers are dissatisfied with various factors for cultivation of onion production. Inputs like, fertilizer availability and its adequate supply were major constraint in the study area. Government needs to ensure constant supply of inputs and check hoarding by the various intermediaries. Hence it would be better if the fertilizer subsidy is brought under DBT (Direct benefit transfer scheme) in all states.

e) There is shortage of storage facilities in the study area and the onion pricesare low during the peak season. Therefore, it is suggested that proper storage facilities need to be created at major production centres.

f) *Off farm problems* comes as and when the product is brought to market during lean season in an attempt to garner higher prices. State and central cooperative agricultural marketing agencies in the states should go for staggered/ phase wise purchase as onion is consumed throughout the year.

g) Cost and returns are viable options to know profitability of an enterprise. Amongst various costs, the cost of harvesting and curing were found to be highest in state.

h) Returns per hectare were quite good in all the districts and was found to be profitable in cost and return analysis. The present study reveals that some districts experienced higher cost of production due to higher labour and input costs. However, in most of the districts, farm operations were efficient.

i) It was found that various factors like physical, biological, socio-economic and institutional are responsible for yield gaps. This can be effectively improved through participatory research at different levels, contract farming and government attention. With greater push towards eNAMand digital literacy, markets can also be a driver for technological dissemination.

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