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## Assessment of application of foliar nutrients on yield and quality of field pea (*Pisum sativum*)

**VB Gohil, CK Patel, JR Patel and SK Patel**

### Abstract

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, and Sardarkrushinagar during *rabi* season of the year 2017-18 on "Assessment of application of foliar nutrients on yield and quality of field pea (*Pisum sativum*)". In all 12 treatment combinations consisting of two levels of inorganic fertilizers viz., 75 % RDF (N<sub>1</sub>) (15: 30: 00 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg/ha) and 100 % RDF (N<sub>2</sub>) (20: 40: 00 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg/ha) and six foliar sprays at flowering and pod initiation stage viz., Water spray (F<sub>1</sub>), 1 % Urea (F<sub>2</sub>), 1 % 19:19:19 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O (F<sub>3</sub>), 1 % Phosphoric acid (F<sub>4</sub>), 1 % 17:44:00 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O (F<sub>5</sub>), 1 % 00:00:50 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O (F<sub>6</sub>) were tried in FRBD (Factorial Randomized Block Design) with three replications. In all cases, application of 100 % RDF (N<sub>2</sub>) was found superior than 75 % RDF (N<sub>1</sub>), application of 100 % RDF (N<sub>2</sub>) recorded significantly higher grain yield (1423 kg/ha) and straw yield (1915 kg/ha) of field pea. The highest benefit : cost ratio (BCR) value (2.24) and net realization (29640 ₹/ha) were obtained under 100 % RDF (N<sub>2</sub>). One per cent foliar spray of 19:19:19 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O (F<sub>3</sub>) at flowering and pod initiation stage recorded significantly the highest grain yield (1650 kg/ha) and straw yield (2228 kg/ha) of field pea. The higher BCR value (2.62) and net realization (38450 ₹/ha) were obtained under 1 % foliar spray of 19:19:19 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O (F<sub>3</sub>) at flowering and pod initiation stage. The interaction effect of different levels of inorganic fertilizers and foliar spray on grain yield/plant (g), grain yield (kg/ha) and straw yield (kg/ha) was found significant. Treatment combination N<sub>2</sub>F<sub>3</sub> (100 % RDF and foliar spray of 1 % 19:19:19 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O) produced significantly the highest grain yield/plant (12.93 g/plant), grain yield (1800 kg/ha) and straw yield (2430 kg/ha). The interaction effect of different levels of inorganic fertilizers and foliar spray on rest of the parameters under study was found non-significant.

**Keywords:** Triclosan, TCS, determination, detection, sensor

### Introduction

Pea belongs to the family leguminosae. It is an annual plant, grown in cool season in many parts of the world. It may be classified in to two classes: (i) Garden or table pea (*Pisum sativum* var. hortense). Green seeds of this type are used for vegetable purpose and for canning and (2) Field pea (*Pisum sativum* L. var. arvense). Garden pea is used as vegetable, fresh, frozen or canned and is also grown to produce dry peas like the split pea. These varieties are typically called field peas. Mature seeds of this type are also used as 'dal.' This type is also used for green manuring. Green seeds are also canned for the use in the off season. Foliar applications of fertilizers are one of the ways of using fertilizers more efficiently and economically. Chemical fertilizers and urea play vital role in crop production. Nutrient supply system is considered as one of the basic factor. It has been established beyond doubt that there is a positive correlation between fertilizer use and crop productivity. Foliar application of major plant nutrients like nitrogen was found to be a good as soil application (Subramanian and Palaniappan, 1981) [12]. Any restriction to the photosynthesis due to depletion of nitrogen in the leaves during the pod filling period due to poor nitrogen uptake from the soil and translocation of this element from leaves to the developing seeds may lead to the acceleration of leaf senescence. The positive effect of supplying legume plants with supplementary nitrogen was found to be beneficial effect on increasing seed yield.

### Materials and Methods

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of the year 2017-18. The experimental soil is loamy in texture with low in organic carbon (0.31 g/kg), available N (136.56 kg/ha) and available P (43.41 kg/ha) but high in available K (253.02 kg/ha).

In all 12 treatment combinations consisting of two levels of inorganic fertilizers [75 % RDF (N<sub>1</sub>) and 100 % RDF (N<sub>2</sub>)] and six foliar sprays at flowering and pod initiation stage [Water spray (F<sub>1</sub>), 1 % Urea (F<sub>2</sub>), 1 % 19:19:19 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O (F<sub>3</sub>), 1 % Phosphoric acid (F<sub>4</sub>), 1 % 17:44:00 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O (F<sub>5</sub>), 1 % 00:00:50 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O (F<sub>6</sub>)] were tested in Factorial RBD with three replications. Field pea cultivar Dantiwada field pea 1 was sown on 8<sup>th</sup> November at 30 cm×10 cm spacing. Crop was fertilized as per treatments. Two hand weeding and one interculturing were carried out during the early crop growth stages. Observations related to growth characters viz., plant height, number of branches per plant and yield attributes (number of pods per plant and seed per pods) at harvest stage were recorded from pre tagged plants. Seed and straw yields from net plot area were recorded.

## Results and Discussion

### Effect inorganic fertilizers

The results given in table 1 revealed that yield attributes as well as seed and straw yields were significantly influenced by inorganic fertilizers treatment. Application of 100% RDF (N<sub>2</sub>) increased number of pods/plant and number of seeds/pod over 75% RDF (N<sub>1</sub>). The increase in different yield attributing characters might be due to might be due to supply of more nutrients at critical crop growth stages and maximum availability of nutrients for photosynthetic activity, which, ultimately enhanced utilization of photosynthates and resulted in more number of pods/plant (Batra *et al.* 2006). Further, the results revealed that treatment N<sub>2</sub> (100 % RDF) recorded significantly higher grain yield/plant (9.97 g/plant), grain yield (1038 kg/ha) and straw yield (3590 kg/ha) as compared to control. The results are in conformity with those reported by Patel *et al.*, (2012) [9] and Bahadur, V. and Singh, T. (1990) [11].

Treatment N<sub>2</sub> (100% RDF) recorded significantly higher protein content (20.6%), While lower protein content (18.5%) was recorded under N<sub>1</sub> (75% RDF) in grains of field pea. The improvement in protein content might be at tribute to higher uptake of nitrogen during growth period which increased photosynthesis, synthesis of protoplasm and protein for higher rate of mitosis. These finding are in general agreement with the experimental results reported by Venkatesh and Basu (2011) [15] in chickpea; Yadav and Choudhary (2012) [16] in cowpea and Doss *et al.* (2013) [3] in black gram.

### Effect of foliar spray

The yield attributes viz., number of pods/plant, number of seeds/pod; grain yield and straw yield (Table 1) were affected significantly due to foliar spray treatments. Application of foliar spray of 1 % 19:19:19 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O at flowering and pod initiation stage (F<sub>3</sub>) remarkably increased the number of

pods/plant (27.0) and number of grains/pod (3.5). Significantly the lowest values of all the above mentioned yield attributes were registered under treatment F<sub>1</sub> [Water spray]. This might be due to adequate supply of nutrient from foliar spray on vegetation. Optimum availability of all nutrients at flower initiation stages of crop growth might have caused efficient translocation of photosynthates from source to sink. Decreased the flower drop due to prolonged assimilatory activity of leaves might be another possible reason for higher number of pods/plant. The foliar application at the flower and pod initiation stages might have been effectively absorbed and translocated to the pods resulting in more number of pods/plant. The results are in closing confirmative with the findings of Marimuthu and Surendran (2015) [7].

Among the foliar spray treatments, application of foliar spray of 1 % 19:19:19 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O at flowering and pod initiation stage (F<sub>3</sub>) recorded significantly higher grain yield/plant (11.33 g/plant), grain yield (1650 kg/ha) and straw yield (2228 kg/ha). Higher grain yield in foliar nutrients was mainly due to the favor of growth, physiological and yield attributing characters like plant height, number of branches/plant, number of pods/plant, number of grains/pod and grain yield/plant. The straw yield enhancement due to the different treatments might be due to continuous supply of nutrients which in turn increased the leaf area and dry matter production resulting in higher straw yield. The increase in yield with foliar nutrition was also reported by Roy *et al.* (1988) [11] and Dwivedi and Tiwari (1991) [4]. Tomar *et al.* (2001) [14] have reported similar findings.

Treatment F<sub>3</sub> (foliar spray of 1 % 19:19:19 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O at flowering and pod initiation stage) recorded significantly the higher protein content (21.9 %) in grains of field pea, While lower protein content (17.6 %) was recorded under F<sub>1</sub> (Water spray) in grains of field pea. Increase in protein content with the foliar fertilization might be due to increased root activity and translocation of higher nitrogen and other nutrients. These results are in complete agreement with those obtained by Palta *et al.* (2005) [8] and Garg and Burman (2006) [6].

### Interaction

In the case of grain yield/plant, grain yield and straw yield (Table 1) N × F interaction effect was found to be significant. Application of (100 % RDF and 1 % 19:19:19 N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O at flowering and pod initiation stage) resulted into significantly higher grain yield/plant (12.93 g/plant), grain yield (1800 kg/ha) and straw yield (2430 kg/ha).

These results are in line with those published by Yadav *et al.* (1993) [17], Ravi *et al.* (1998) [10], Bahadur and Singh (1990) [1], Ganga *et al.* (2004) [5] and Sundaram and Kanthaswamy (2005) [13].

**Table 1:** Effect of inorganic fertilizers and foliar spray on yield attributes, yield and quality characters of field pea

Treatments	Number of pods/plant	Number of grain/pod	Grain yield (kg/ha)	Straw yield (kg/ha)	Protein content (%)	Protein yield (kg/ha)	
<b>Inorganic fertilizers (N) :</b>							
N <sub>1</sub> :	75 % RDF (15:30:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	28.42	3.8	1250	1695	18.5	234
N <sub>2</sub> :	100 % RDF (20:40:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	32.34	4.4	1423	1915	20.6	294
	S.Em.±	0.74	0.17	37	51	0.24	8.56
	C.D. at 5 %	2.17	0.24	109	150	0.84	25.09
<b>Foliar spray (F) :</b>							
F <sub>1</sub> :	Water spray	27.00	3.5	1212	1636	17.6	424
F <sub>2</sub> :	1 % Urea at flowering and pod initiation stage	29.83	3.9	1282	1746	19.8	464
F <sub>3</sub> :	1 % 19:19:19 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	37.00	5.0	1650	2228	21.9	595
F <sub>4</sub> :	1 % Phosphoric acid at flowering and pod initiation stage	29.30	3.9	1278	1714	19.5	402
F <sub>5</sub> :	1 % 17:44:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	30.50	4.0	1340	1810	20.3	487

F <sub>6</sub> :	1 % 00:00:50 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	28.67	3.7	1257	1697	18.2	435
	S.Em.±	1.28	0.19	65	89	0.50	31.66
	C.D. at 5 %	3.76	0.54	189	260	1.47	92.97
Interaction (N × F) :							
	S.Em.±	1.81	0.28	91	125	0.75	44.87
	C.D. at 5 %	NS	NS	268	368	NS	NS
	C.V. (%)	10.34	10.14	11.83	12.04	6.24	16.53

**Table 1 (a):** Interaction effect of inorganic fertilizers and foliar spray on grain yield (g/plant) of field pea

Treatments	F <sub>1</sub> : Water spray	F <sub>2</sub> : 1 % Urea at flowering and pod initiation stage	F <sub>3</sub> : 1 % 19:19:19 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	F <sub>4</sub> : 1 % Phosphoric acid at flowering and pod initiation stage	F <sub>5</sub> : 1 % 17:44:00 at flowering and pod initiation stage	F <sub>6</sub> : 1 % 00:00:50 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage
N <sub>1</sub> : 75 % RDF (15:30:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	6.54	7.26	9.74	7.04	8.70	6.91
N <sub>2</sub> : 100 % RDF (20:40:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	7.88	11.33	12.93	8.34	11.37	7.96
S.Em.±	0.52					
C.D. at 5%	1.52					
C.V. (%)	10.15					

**Table 1 (b):** Interaction effect of inorganic fertilizers and foliar spray on grain yield (kg/ha) of field pea

Treatments	F <sub>1</sub> : Water spray	F <sub>2</sub> : 1 % Urea at flowering and pod initiation stage	F <sub>3</sub> : 1 % 19:19:19N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	F <sub>4</sub> : 1 % Phosphoric acid at flowering and pod initiation stage	F <sub>5</sub> : 1 % 17:44:00 at flowering and pod initiation stage	F <sub>6</sub> : 1 % 00:00:50 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage
N <sub>1</sub> : 75 % RDF (15:30:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	1033	14886	1500	1053	1166	1260
N <sub>2</sub> : 100 % RDF (20:40:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	1390	1076	1800	1501	1513	1253
S.Em.±	91					
C.D. at 5%	268					
C.V. (%)	11.83					

**Table 1 (c):** Interaction effect of inorganic fertilizers and foliar spray on straw yield (kg/ha) of field pea

Treatments	F <sub>1</sub> : Water spray	F <sub>2</sub> : 1 % Urea at flowering and pod initiation stage	F <sub>3</sub> : 1 % 19:19:19 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage	F <sub>4</sub> : 1 % Phosphoric acid at flowering and pod initiation stage	F <sub>5</sub> : 1 % 17:44:00 at flowering and pod initiation stage	F <sub>6</sub> : 1 % 00:00:50 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O at flowering and pod initiation stage
N <sub>1</sub> : 75 % RDF (15:30:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	1395	1465	2025	2007	1575	1701
N <sub>2</sub> : 100 % RDF (20:40:00 N : P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O kg/ha)	1876	2027	2430	1420	2043	1692
S.Em.±	125					
C.D. at 5%	368					
C.V. (%)	12.04					

**Table 2:** Economics of different treatment combinations of inorganic fertilizers and foliar spray

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Total cost (₹/ha)	Gross realization (₹/ha)	Net realization (₹/ha)	BCR
N <sub>1</sub> F <sub>1</sub>	1033	1395	22735	38945	16210	
N <sub>1</sub> F <sub>2</sub>	1487	1465	22795	54975	32180	1.71
N <sub>1</sub> F <sub>3</sub>	1500	2025	23485	56550	33065	2.41
N <sub>1</sub> F <sub>4</sub>	1053	2007	24775	40869	16094	2.41
N <sub>1</sub> F <sub>5</sub>	1167	1575	23445	43995	20550	1.65
N <sub>1</sub> F <sub>6</sub>	1260	1701	23475	47502	24027	1.88
N <sub>2</sub> F <sub>1</sub>	1390	1877	23278	52404	29126	2.02
N <sub>2</sub> F <sub>2</sub>	1077	2027	23338	41749	18411	2.25
N <sub>2</sub> F <sub>3</sub>	1800	2430	24028	67860	43832	1.79
N <sub>2</sub> F <sub>4</sub>	1501	1420	25318	55375	30057	2.82
N <sub>2</sub> F <sub>5</sub>	1513	2043	23988	57041	33053	2.19
N <sub>2</sub> F <sub>6</sub>	1253	1692	24018	47239	23221	2.38
						1.97

Note: Selling price of field pea grain = 35 (Rs./kg) and stover = 2.0 (Rs./kg)

## Economics

### Effect of inorganic fertilizers

The data on economics of different levels of inorganic fertilizers are presented in Table 2. Treatment N<sub>2</sub> (100 %

RDF) was found superior by recording the higher values of net realization (31397 ₹/ha) and benefit: cost ratio (2.41). The treatment N<sub>1</sub> (75 % RDF) showed the lower value of net realization (25445 ₹/ha) and benefit: cost ratio (2.17).

**Effect of foliar spray**

The data on economics of different foliar sprays are presented in Table 4.24. Treatment F<sub>3</sub> (foliar spray of 1 % 19:19:19 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O at flowering and pod initiation stage) was found superior by recording the highest values of net realization (41518 ₹/ha) and benefit: cost ratio (3.01) over F<sub>1</sub> (Water spray) having net realization of 25097 ₹/ha and benefit: cost ratio of 2.22.

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