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Assessment of Application of Foliar Nutrients on Yield and Quality of Field pea (*Pisum sativum*)

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Abstract
A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, 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_1) (15: 30: 00 N: P_2O_5: K_2O kg/ha) and 100 % RDF (N_2) (20: 40: 00 N: P_2O_5: K_2O kg/ha) and six foliar sprays at flowering and pod initiation stage viz., Water spray (F_1), 1 % Urea (F_2), 1 % 19:19:19 N: P_2O_5: K_2O (F_3), 1 % Phosphoric acid (F_4), 1 % 17:44:00 N: P_2O_5: K_2O (F_5), 1 % 00:00:50 N: P_2O_5: K_2O (F_6) were tried in FRBD (Factorial Randomized Block Design) with three replications. In all cases, application of 100 % RDF (N2) was found superior than 75 % RDF (N_1), application of 100 % RDF (N_2) 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_2).One per cent foliar spray of 19:19:19 N: P_2O_5: K_2O (F_3) 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_2O_5: K_2O (F_3) 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_2F_3 (100 % RDF and foliar spray of 1 % 19:19:19 N: P_2O_5: K_2O) 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: different, interaction, Agronomy, non-significant, spray

Introduction
Pea belongs to the family leguminoceae. 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_1) and 100 % RDF (N_2)] and six foliar sprays at flowering and pod initiation stage [Water spray (F_1), 1 % Urea (F_2), 1 % 19:19:19 N: P_2O_5: K2O (F_3), 1 % Phosphoric acid (F_4), 1 % 17:44:00 N: P_2O_5: K_2O (F_5), 1 % 00:00:50 N: P_2O_5: K_2O (F_6)] were tested in Factorial RBD with three replications. Field pea cultivar Dantiwada field pea 1 was sown on 8th 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_2) increased number of pods/plant and number of seeds/pod over 75 % RDF (N_1). 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) [2]. Further, the results revealed that treatment N_2 (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) [1].

Treatment N_2 (100 % RDF) recorded significantly higher protein content (20.6 %), While lower protein content (18.5 %) was recorded under N_1 (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_2O_5: K_2O at flowering and pod initiation stage (F_3) 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_1 [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_2O_5: K_2O at flowering and pod initiation stage (F_3) 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_3 (foliar spray of 1 % 19:19:19 N: P_2O_5: K_2O 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_1 (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_2O_5: K_2O 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].

Economics

Effect of inorganic fertilizers

The data on economics of different levels of inorganic fertilizers are presented in Table 2. Treatment N_2 (100 % RDF) was found superior by recording the higher values of net realization (31397 ₹/ha) and benefit: cost ratio (2.41). The treatmentN_1 (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_3 (foliar spray of 1 % 19:19:19 N: P_2O_5: K_2O 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_1 (Water spray) having net realization of 25097 ₹/ha and benefit: cost ratio of 2.22.

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)
Inorganic fertilizers (N)						
N_1 : 75 % RDF (15:30:00 N: P_2O_5: K_2O kg/ha)	28.42	3.8	1250	1695	18.5	234
N_2 : 100 % RDF (20:40:00 N: P_2O_5: K_2O 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
Foliar spray (F)						
F_1 : Water spray	27.00	3.5	1212	1636	17.6	424
F_2 : 1 % Urea at flowering and pod initiation stage	29.83	3.9	1282	1746	19.8	464
F_3 : 1 % 19:19:19 N: P_2O_5: K_2O at flowering and pod initiation stage	37.00	5.0	1650	2228	21.9	595

F_4 : 1 % Phosphoric acid at flowering and pod initiation stage	29.30	3.9	1278	1714	19.5	402
F_5 : 1 % 17:44:00 N: P_2O_5: K_2O at flowering and pod initiation stage	30.50	4.0	1340	1810	20.3	487
F_6 : 1 % 00:00:50 N: P_2O_5: K_2O 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_1: Water spray	F_2: 1 % Urea at flowering and pod initiation stage	F_3: 1 % 19:19:19 N: P_2O_5: K_2O at flowering and pod initiation stage	F_4: 1 % Phosphoric acid at flowering and pod initiation stage	F_5: 1 % 17:44:00 at flowering and pod initiation stage	F_6: 1 % 00:00:50 N: P_2O_5: K_2O at flowering and pod initiation stage
N_1: 75 % RDF (15:30:00 N: P_2O_5: K_2O kg/ha)	6.54	7.26	9.74	7.04	8.70	6.91
N_2: 100 % RDF (20:40:00 N: P_2O_5: K_2O 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_1: Water spray	F_2: 1 % Urea at flowering and pod initiation stage	F_3: 1 % 19:19:19 N: P_2O_5: K_2O at flowering and pod initiation stage	F_4: 1 % Phosphoric acid at flowering and pod initiation stage	F_5: 1 % 17:44:00 at flowering and pod initiation stage	F_6: 1 % 00:00:50 N: P_2O_5: K_2O at flowering and pod initiation stage
N_1: 75 % RDF (15:30:00 N: P_2O_5: K_2O kg/ha)	1033	14S86	1500	1053	1166	1260
N_2: 100 % RDF (20:40:00 N: P_2O_5: K_2O 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_1: Water spray	F_2: 1 % Urea at flowering and pod initiation stage	F_3: 1 % 19:19:19 N: P_2O_5: K_2O at flowering and pod initiation stage	F_4: 1 % Phosphoric acid at flowering and pod initiation stage	F_5: 1 % 17:44:00 at flowering and pod initiation stage	F_6: 1 % 00:00:50 N: P_2O_5: K_2O at flowering and pod initiation stage
N_1: 75 % RDF (15:30:00 N: P_2O_5: K_2O kg/ha)	1395	1465	2025	2007	1575	1701
N_2: 100 % RDF (20:40:00 N: P_2O_5: K_2O 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_1 F_1	1033	1395	22735	38945	16210	1.71
N_1 F_2	1487	1465	22795	54975	32180	2.41
N_1 F_3	1500	2025	23485	56550	33065	2.41
N_1 F_4	1053	2007	24775	40869	16094	1.65
N_1 F_5	1167	1575	23445	43995	20550	1.88
N_1 F_6	1260	1701	23475	47502	24027	2.02
N_2 F_1	1390	1877	23278	52404	29126	2.25
N_2 F_2	1077	2027	23338	41749	18411	1.79
N_2 F_3	1800	2430	24028	67860	43832	2.82
N_2 F_4	1501	1420	25318	55375	30057	2.19
N_2 F_5	1513	2043	23988	57041	33053	2.38
N_2 F_6	1253	1692	24018	47239	23221	1.97

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

References

1. Bahadur V, Singh T. Yield and growth response of garden pea (*Pisum sativum*) to nitrogen and phosphorus application. Vegetable Science. 1990; 17:205-209.
2. Batra VK, Dhankhar SK, Bhatia AK, Singh V, Arora SK, Singh V. Response of brinjal to foliar feeding of

water soluble fertilizers. Haryana Journal of Horticultural Sciences. 2006; 35:317-322.
3. Doss A, Anand SP, Keerthiga M. Effect of foliar application of diammonium phosphate (DAP), potash (K) and naphthalene acetic acid (NAA) on growth, yield and some biochemical constituents of black gram. Woodpecker Journal of Agricultural Research. 2013; 2(7):206-208.
4. Dwivedi RK, Tiwari OP. Effect of irrigation and nutrient spray on chickpea in rice fallows. Indian Journal of Pulses Research. 1991; 4(2):213-214.
5. Ganga N, Singh RK, Singh RP, Choudhury SK, Upadhyay PK. Effect of potassium levels and foliar application of nutrients on growth of late sown chickpea. Environment and Ecology. 2004; 32(1A):273-275.
6. Garg BK, Burman U. Influence of thiourea on photosynthesis, nitrogen metabolism and yield of clusterbean (*Cyamopsis tetragonoloba*) under rainfed conditions of Indian arid zone. Plant Growth Regulators. 2006; 48:237-245.
7. Marimuthu S, Surendran U. Effect of nutrients and plant growth regulators on growth and yield of black gram in sandy loam soils of Cauvery new delta zone. Indian Cogent Food and Agriculture. 2015; 1:415.
8. Palta JA, Nandwal AS, Kumari S, Turner NC. Foliar nitrogen applications increase the seed yield and protein content in chickpea (*Cicer arietinum*) subject to terminal drought. Australian Journal of Agricultural Research. 2005; 56(2):105-112.
9. Patel RD. Response of different cultivar of green gram (*Vigna radiata*) to integrated nutrient management under south Gujarat condition. MSc. (Agri.) Thesis, Submitted to Navsari Agricultural University, Navsari, 2012.
10. Ravi N, Sharma HM, Singh RNP. Response of late-sown chickpea to irrigation and foliar nutrition in calcareous soil. Journal of Applied Biology. 1998; 8(2):5-8.
11. Roy RK, Sharma RP, Singh KJP. Effect of irrigation and foliar spray of nutrients on the yield of late sown chick pea. International Chickpea News Letter. 1998; 18:33-34.
12. Subramanian A, Palaniappan SP. Effect of methods of planting, plant density and fertilization on yield of black gram in irrigated system. Madras Journal of Agriculture. 1981; 68:96-99.
13. Sundaram V, Kanthaswamy V. Response of okra to foliar feeding of water soluble fertilizers. Vegetable Science. 2005; 32(1):92-93.
14. Tomar A, Kumar N, Pareek RP, Chaube AK. Synergism among VAM, phosphate solubilizing bacteria and rhizobium for symbiosis with black gram (*Vigna mungo*) under field conditions. Pedosphere. 2001; 11(4):327-332.
15. Venkatesh MS, Basu PS. Effect of foliar application of urea on growth, yield and quality of chickpea under rainfed conditions. Journal of Food Legumes. 2011; 24(2):110-112.
16. Yadav LR, Choudhary GL. Effect of fertility levels and foliar nutrition on productivity, nutrient content and uptake of cowpea. Legume Research. 2012; 35(3):258-260.
17. Yadav RP, Chauhan DVS, Kushvaha HS. Effect of irrigation, phosphorus and row spacing on physiological characters of pea (*Pisum sativum*). Indian Journal of Agronomy. 1993; 38:25-27.