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## Effect of foliar application of water soluble fertilizers and micronutrients on quality parameters of vegetable pea (*Pisum sativum* L.)

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#### Abstract

The present investigation entitled “Effect of foliar application of water soluble fertilizers and micronutrients on quality parameters of vegetable pea (*Pisum sativum* L.)” was conducted at the Horticultural Research cum Instructional Farm, IGKV, Raipur (C.G.) during the year 2020-21 and 2021-22 in *Rabi* season. The experiment was comprised of with eleven treatments which were laid out in Randomize Block Design with three replications. Result showed that the quality parameters like chlorophyll content, protein content in dry seed (%), shelling (%) was recorded maximum in treatment T10: Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 2% before and after flowering. However, all quality parameters are noticed minimum in treatment T<sub>11</sub> (Control: Recommended NPK).

**Keywords:** Foliar application, water soluble fertilizers, micronutrients, vegetable pea (*Pisum sativum* L.)

#### Introduction

Garden pea (*Pisum sativum* L.) is one of the most important pulse crops among the various grain legumes grown in India and second most important legume crop of the world (Pawar *et al.* 2017) [12]. According to Vavilov (1951) [16], it is native to Mediterranean region of Southern Europe & Western Asia; belong to the family Leguminaceae (Sub. family Papilionaceae) is cool season nutritive vegetable crop. This legume contain high percentage of digestible protein (7.2 g), carbohydrates (15.8 g), vitamin A (139 I.U.), vitamin C (9 mg), magnesium (34 mg), phosphorus (139 mg) and essential amino acids per 100 g of edible portion (Gopalan *et al.* 2007) [3]. It can be consumed either fresh, canned, pulse, frozen or in dehydrated forms. This crop and it's by products can also be used as fodder. It is used as green manure as well (Makasheva, 1983) [7].

In world major green pea cultivated countries China, India, United States of America, France, Egypt, Pakistan, Peru, Algeria, United Kingdom Russian and Federation. In India, the pea occupies 575 thousand hectares with production of 5855 thousand tonnes (Anonymous, 2021a) [1]. Major pea cultivated states is Uttar Pradesh, Jharkhand, Punjab, West Bengal, Haryana, Andhra Pradesh, Bihar, Uttarakhand, Madhya Pradesh, and Himachal Pradesh, where it is grown for both vegetable and pulse purposes and is a highly remunerative crop (Singh *et al.*, 2005) [14]. In Chhattisgarh, the area under pea cultivation is 8.68 thousand hectares with production of 117.55 thousand tonnes (Anonymous, 2021b) [2]. Major pea cultivated district in Chhattisgarh is Rajnandgaon, Sarguja, Surajpur, Korea and Raigarh.

Foliar fertilization, recently, has been widely used and accepted as an essential part of crop production like horticultural crops. This method of application has mainly been used where nutrients are required in only small amounts or when a quick plant response to fertilizer is desired (Kolota and Osinska, 1999) [6]. Foliar feeding with macro and micronutrients are more effective in terms of attaining maximum yield and quality of vegetable crops thus reduction in losses, when plant crops are cultivated in micronutrient deficient soils, they possess low micronutrients content and consequently low bioavailability (Manea *et al.*, 2019) [8]. Now a days application of macro and micro-nutrients in different ratios through foliar sprays is modern method of fertilization in vegetable crops due to the nature of heavy feeder of nutrients. Fertilizer such as nitrogen, phosphorus and potassium are the most important nutrient. Micronutrients are usually required in minute quantities, nevertheless are vital to the growth of plant.

Application of micronutrients is less expensive but can give higher profits than other nutrients (Solanki *et al.*, 2010) [15]. They improve general condition of plants and are known to act as catalysts in promoting organic reactions taking place in plant. Six micronutrients *i.e.*, Mn, Fe, Cu, Zn, B and Mo are known to be required for all higher plants.

## Materials and Method

The present experiment was conducted at Horticultural Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *Rabi* season

of year 2020-21 and 2021-22 with vegetable pea cultivar Arkel. The experiment was comprised of 11 treatment combination Recommended dose of NPK fertilizers and foliar application of macro and micro nutrients with one control. These treatments combination with their symbols are given in Table 1. The schedules of different pre and post-sowing cultural operations carried out timely during the crop season. Quality parameters *i.e.* chlorophyll content, protein content and shelling percentage measured during course of investigation.

**Table 1:** Treatments combination with their symbols.

S. No.	Symbols	Treatments
1.	T <sub>1</sub>	Recommended NPK + Foliar spray of NPK @ 1% before flowering
2.	T <sub>2</sub>	Recommended NPK + Foliar spray of NPK @ 2% before flowering
3.	T <sub>3</sub>	Recommended NPK + Foliar spray of NPK @ 1% before and after flowering
4.	T <sub>4</sub>	Recommended NPK + Foliar spray of NPK @ 2% before and after flowering
5.	T <sub>5</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @0.25% before flowering
6.	T <sub>6</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering
7.	T <sub>7</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 1% before flowering
8.	T <sub>8</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 2% before flowering
9.	T <sub>9</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 1% before and after flowering
10.	T <sub>10</sub>	Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 2% before and after flowering
11.	T <sub>11</sub>	Control (Recommended NPK)

## Results and Discussion

### 1. Chlorophyll content (SPAD value)

The significant differences were observed in chlorophyll content by application of various treatments in first year, second year and pooled mean, respectively. The chlorophyll content was recorded in experimental period are presented in Table 2.

The chlorophyll content was recorded highest under treatments, T<sub>10</sub> (46.34, 45.95 and 46.15) in both the year and pooled mean, respectively. This was significantly superior over other treatments but statistically *at par* with treatment T<sub>8</sub> (42.54, 44.06 and 43.30), T<sub>9</sub> (42.24, 43.42 and 42.83) and T<sub>7</sub> (41.96, 42.65 and 42.31) in first year, second year and pooled mean, respectively. However, control treatment T<sub>11</sub> (32.00, 30.29 and 31.15) was recorded lowest chlorophyll content in both the year and pooled mean, respectively.

In our study higher SPAD value was recorded with foliar application of 0.25% IIHR micronutrient mixture. This was might be due to effect of Mg on chlorophyll accumulation could be attributed to the useful importance of magnesium for photosynthesis, net assimilation and transpiration rates (Nobel, 1991) [11]. The Mg not only serves as central atom of chlorophyll molecules but it is also necessary in chlorophyll biosynthesis, activating Mg chelatase, a complex enzyme which catalyzes the insertion of Mg in to a chlorophyll precursor molecule (Reid and Hunter, 2004 and Masuda, 2008) [13, 10].

### 2. Protein content in dry seed (%)

No significant difference among various treatments was observed in protein content in dry seed was recorded in investigation are presented in Table 3.

The protein content in dry seed was noticed maximum under treatment T<sub>10</sub> (15.64, 16.77 and 16.21%) followed by T<sub>8</sub> (15.43, 16.21 and 15.82%) and T<sub>9</sub> (14.09, 15.18 and 14.64%) in first year, second year and pooled mean, respectively. Whereas, treatment T<sub>11</sub> (11.04, 11.76 and 11.40%) was recorded minimum protein content in dry seed in first year, second year and pooled mean, respectively.

Our results showed that protein content was increased when N value increased in plants, this may be due to fact that nitrogen has an important role in the protein synthesis, thereby protein content increased with increasing N value in the plant. Zinc is an essential element for plants that act as a metal component of various enzymes or as a functional structural or regulatory cofactor and for protein synthesis, photosynthesis, the synthesis of auxin, cell division, and sexual fertilization (Marschner, 1995) [9]. Zinc plays a special role in synthesizing proteins, RNA and DNA (Kobraee *et al.*, 2011) [5]. According to results of (Hemmati, 2005) [4] studies, application of micronutrient iron, zinc and manganese on average two percentage has increased seed protein in bean.

### 3. Shelling (%)

No significant difference among various treatments was observed in shelling% was recorded in investigation are presented in Table 4.

The shelling% was noticed maximum under treatment T<sub>10</sub> (44.61, 44.79 and 44.70%) followed by T<sub>8</sub> (44.48, 44.35 and 44.42%) and T<sub>9</sub> (44.05, 43.38 and 43.97%) in first year, second year and pooled mean, respectively. Whereas, treatment T<sub>11</sub> (42.08, 42.50 and 42.29%) was recorded minimum shelling% in first year, second year and pooled mean, respectively.

**Table 2:** Effect of foliar application of water soluble fertilizers and micronutrients on chlorophyll content of vegetable pea.

Treatments	Chlorophyll content (%)		
	2020-21	2021-22	Pooled
T <sub>1</sub> : Recommended NPK + Foliar spray of NPK @ 1% before flowering	36.80	36.42	36.61
T <sub>2</sub> : Recommended NPK + Foliar spray of NPK @ 2% before flowering	38.10	37.39	37.75
T <sub>3</sub> : Recommended NPK + Foliar spray of NPK @ 1% before and after flowering	38.08	37.38	37.73
T <sub>4</sub> : Recommended NPK + Foliar spray of NPK @ 2% before and after flowering	39.17	38.04	38.61
T <sub>5</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering	40.69	38.10	39.40
T <sub>6</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering	41.32	40.27	40.80
T <sub>7</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 1% before flowering	41.96	42.65	42.31
T <sub>8</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 2% before flowering	42.54	44.06	43.30
T <sub>9</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 1% before and after flowering	42.24	43.42	42.83
T <sub>10</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 2% before and after flowering	46.34	45.95	46.15
T <sub>11</sub> : Control (Recommended NPK)	32.00	30.29	31.15
SEm (±)	1.68	1.88	1.78
CV (%)	7.29	8.25	7.78
CD (p=0.05)	4.96	5.54	5.09

**Table 3:** Effect of foliar application of water soluble fertilizers and micronutrients on protein content in dry seed (%) of vegetable pea.

Treatments	Protein content in dry seed (%)		
	2020-21	2021-22	Pooled
T <sub>1</sub> : Recommended NPK + Foliar spray of NPK @ 1% before flowering	11.11	12.56	11.84
T <sub>2</sub> : Recommended NPK + Foliar spray of NPK @ 2% before flowering	11.60	13.37	12.49
T <sub>3</sub> : Recommended NPK + Foliar spray of NPK @ 1% before and after flowering	11.34	13.13	12.24
T <sub>4</sub> : Recommended NPK + Foliar spray of NPK @ 2% before and after flowering	12.23	14.15	13.19
T <sub>5</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering	12.27	14.21	13.24
T <sub>6</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering	13.62	14.70	14.16
T <sub>7</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 1% before flowering	14.02	14.89	14.46
T <sub>8</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 2% before flowering	15.43	16.21	15.82
T <sub>9</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 1% before and after flowering	14.09	15.18	14.64
T <sub>10</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 2% before and after flowering	15.64	16.77	16.21
T <sub>11</sub> : Control (Recommended NPK)	11.04	11.76	11.40
SEm (±)	1.12	1.58	1.37
CV (%)	15.00	19.14	17.41
CD (p=0.05)	NS	NS	NS

**Table 4:** Effect of foliar application of water soluble fertilizers and micronutrients on shelling (%) of vegetable pea.

Treatments	Shelling (%)		
	2020-21	2021-22	Pooled
T <sub>1</sub> : Recommended NPK + Foliar spray of NPK @ 1% before flowering	42.12	42.61	42.37
T <sub>2</sub> : Recommended NPK + Foliar spray of NPK @ 2% before flowering	43.04	43.09	43.07
T <sub>3</sub> : Recommended NPK + Foliar spray of NPK @ 1% before and after flowering	42.99	42.75	42.87
T <sub>4</sub> : Recommended NPK + Foliar spray of NPK @ 2% before and after flowering	43.19	43.31	43.25
T <sub>5</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering	43.34	43.39	43.37
T <sub>6</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering	43.97	43.43	43.70
T <sub>7</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 1% before flowering	44.04	43.63	43.84
T <sub>8</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before flowering + foliar spray of NPK @ 2% before flowering	44.48	44.35	44.42
T <sub>9</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 1% before and after flowering	44.05	43.88	43.97
T <sub>10</sub> : Recommended NPK + Foliar spray of IIHR micronutrient mixture @ 0.25% before and after flowering + foliar spray of NPK @ 2% before and after flowering	44.61	44.79	44.70
T <sub>11</sub> : Control (Recommended NPK)	42.08	42.50	42.29
SEm (±)	3.27	4.71	4.05
CV (%)	13.03	18.76	16.15
CD (p=0.05)	NS	NS	NS

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