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Effect of thiourea on growth, yield and quality of vegetable cowpea (*Vigna unguiculata* L. Walp)

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Abstract

The field experiment was conducted on "Effect of thiourea on growth, yield and quality of vegetable cowpea (*Vigna unguiculata* L. Walp)" at Horticulture farm, Department of Horticulture, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif*, 2018. The experiment consisting six levels of thiourea (control, seed treatment with 500 ppm thiourea, seed treatment with 1000 ppm thiourea, foliar application of 500 ppm thiourea, foliar application of 1000 ppm thiourea and seed treatment with 500 ppm thiourea + foliar application of 500 ppm thiourea) in randomized block design with three replications. Results indicated that application of seed treatment with thiourea 500 ppm and foliar application of thiourea 500 ppm significantly increased the plant height (64.15 cm), branches per plant, chlorophyll content, pods per plant (24.85), pod length, pod yield per per ha (148.67 q), nitrogen, phoshporus, protein content and crude fiber content in green pod over control and other treatments. The seed treatment with thiourea 500 ppm with foliar application of thiourea 500 ppm found significantly superior with net returns (Rs. 212675/ha) and highest B:C ratio (3.51).

Key words: Growth, quality, thiourea, vegetable cowpea, yield

Introduction

Vegetable cowpea (*Vigna unguiculata* L. Walp.*)* is important leguminous crop originated from central Africa belongs to family Fabaceae. It is widely grown in India in both summer and rainy season as well as all over the world. Cowpea is cosmopolitan and assumes fair degree of importance as pulse as well as vegetable crop. It is also consumed both as green pod and dry seed. Choice of cowpea as vegetable is due to being palatable, highly nutritious and relatively free of metabolites or other toxins.

It is considered inexpensive source of vegetable protein. The green tender pods of vegetable cowpea contain 84.6 % moisture, 4.3 per cent protein, 8.0 % carbohydrates and 0.2 % fats. Cowpea seed contains about 21.2 to 30.6 % protein, 60.3 % carbohydrate, 1.8 % fat and rich source of calcium, phosphorus and iron (Mann, 1975). The protein in the cowpea seeds is rich in amino acids, *viz.,* lycine and tryptophan which are deficient in cereals.

Thiourea is a sulphydryl compound (NH_2-CS-NH_2) known for breaking dormancy, stimulating germination and has also been reported for significantly improving growth, yield and water use efficiency of field crops under arid and semi-arid conditions (Mathur *et al.,* 2006). Thiourea contains 42.10 % sulfur and 36.80 % nitrogen. Soaking of seeds and foliar spray of thiourea have been reported not only to improve growth and development of plants but also the dry matter partitioning for increased grain yield. Thiourea plays a vital role in the physiology of plants. It promotes growth in cytokinin requiring callus tissues in absence of kinetin in various crops (Erez, 1978). Among the stress alleviating compounds, thiourea is an important molecule with two functional groups *thiol* is important to oxidative stress response and *imino* partly fulfils the N requirement. Thiourea has the capability to serve as a potential bio-regulatory molecule to impart multi stress tolerance in plants under field conditions (Srivastava *et al.*, 2009).

Materials and Methods

The experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Jaipur) during *Kharif* 2018. The experiment was laid out in randomized block design with six levels of thiourea (control-T_0, Seed treatment with thiourea 500 ppm-T_1, seed treatment with thiourea 1000 ppm-T_2, foliar application of thiourea 500 ppm-T_3, foliar application of thiourea 1000 ppm-T_4 and seed treatment with thiourea 500 ppm with foliar application of thiourea 500 ppm-T_5) with three replications. Thiourea was used as seed soaking and foliar spray after 50 days of sowing at branching stage and followed by flowering stage as per treatment combinations. Each plot measured 2.0 m x 2.5 m (5 m^2) area. The crop geometry was kept at 40 x 10 cm.

The observations like plant height (cm), number of branches per plant, leaf area (cm^2), number of green pods per plant, green pod length (cm), green pod yield per plant (g), green pod yield per plot (kg), green pod yield per hectare (q) taken manually. Chlorophyll content was determined using the method of Arnon (1949) with slight modifications. Nitrogen content in the green pods was estimated by using

Nesselar's reagent by spectrophotometer method (Snell and Snell, 1949), phosphorus concentration in pod was determined by 'Vanado molybdo' phosphoric acid yellow color method. Digestion of samples was done by tri-acid mixture and the intensity of color was measured by spectrophotometer (Jackson, 1973), protein content in the pods was calculated by multiplying nitrogen concentration (%) by the factor 6.25 (A.O.A.C., 1960). Crude fiber content in pods was determined by the method suggested by A.O.A.C. (1960). The data obtained from the experiment were subjected to statistical analysis and the results were documented, analyzed and presented in tabular form.

Results and Discussion

The data in Table 1 revealed that growth parameters were significantly influenced by the application of thiourea as seed soaking and foliar spray after 50 days of sowing at branching stage of vegetable cowpea crop. The maximum plant height of (47.96 and 64.15 cm) at 30 DAS and at harvesting stage, number of branches per plant (17.89), total chlorophyll content in leaves (2.35 mg/g) and leaf area (429.21 cm^2) at 30 DAS were recorded under treatment T_5 (seed treatment with thiourea @ 500 ppm + foliar application of thiourea 500 ppm) and minimum under control. This treatment was observed as significantly superior over control and other treatments. It might be due to changes the metabolites present in the seedlings as a result in change of activity of hydrolytic enzymes or due to the change in the oxidation mechanisms and especially those concerned with electron transport. The significant effect on all growth parameters also provided a possibility that thiourea might have resulted into creation of more photo-synthetically active leaf for longer period during vegetative and reproduction phases, leading to more absorption and utilization of radiant energy which ultimately resulted in higher plant height, number of branches, leaf area, pods per plant and total chlorophyll content. Similar, results were also reported by Singh *et al.* (2012) in okra and Meena *et al.,* (2016) in cluster bean.

It is evident from data (Table 2 and Fig. 1) that thiourea as seed soaking and foliar spray at branching stage of vegetable cowpea crop significantly increased the yield and yield attributing characters. Total number of pods (24.85), green pod yield per plant (64.64 g), green pod yield per plot (7.43 kg) and pod yield per ha (148.67 q) were found maximum under seed treatment with thiourea 500 ppm with foliar application of thiourea 500 ppm significantly while minimum parameters were recorded under control.

The significant variation in yield attributes and yield obtained with thiourea applied through seed soaking and foliar spray was most probably due to increased photosynthetic activities and source to sink relationship. The bio regulatory effect of thiourea, chiefly through mobilization of dry matter and translocation of photosynthates to sink which ultimately improved the yield. The findings of the present investigation is closely supported by Solanki (2002) in cluster bean, Mani *et al.* (2013) in potato and Singh *et al.* (2012) reported that yield of okra increased significantly by foliar application of thiourea (500 ppm).

A perusal of data presented in Table 3 revealed that the application of different levels of thiourea as seed soaking and foliar spray found significantly increased quality parameters of vegetable cowpea. The maximum nitrogen content (0.682%), phosphorus content (0.078), protein content (4.26%) and crude fiber content (15.09%) in green pods were recorded with the application of T_5 treatment where thiourea was applied as seed treatment 500 ppm with foliar application 500 ppm. The increased accumulation of nutrients especially N, P, protein and crude fibre content in vegetative parts concomitant the improved metabolism led to greater translocation of these nutrients to reproductive structure of crop. Application of thiourea resulted in better utilization of nitrogen and phosphorus in soil probably due to the fact that application of thiourea might have helped in improved metabolic process of plants and better growth and development leading to greater absorption of nutrients from rhizosphere. Solanki (2002) reported that thiourea being a sulphydryl compound significantly improved the root growth

Table 1. Effect of thiourea on growth attributes of vegetable cowpea

Thiourea treatment combinations	Plant height (cm) 30 DAS	Plant height (cm) at harvesting	Number of branches per plant	Total chl. (mg/g)	Leaf area (cm^2)
T_0 -Control	36.21	49.32	12.11	1.72	365.92
T_1 - Seed treatment 500 ppm	39.98	54.49	14.21	1.96	396.64
T_2 - Seed treatment with 1000 ppm	40.25	56.22	14.78	2.06	397.65
T_3 - Foliar spray with 500 ppm	43.89	58.49	15.25	2.11	399.45
T_4 - Foliar Spray with 1000 ppm	44.25	59.68	15.94	2.14	401.15
T_5 - Seed treatment with 500 ppm + foliar spray with 500 ppm	47.96	64.15	17.89	2.35	429.61
SEm ±	1.26	1.41	0.50	0.06	9.67
CD at 5%	3.61	4.06	1.42	0.16	27.80

Table 2. Effect of thiourea on yield and economic attributes of vegetable cowpea

Thiourea treatment combinations	Pod length (cm)	Number of green pods/plant	Pod yield (g/plant)	Pod yield (kg/plot)	Pod yield (q/ha)	Net Returns (Rs./ha)	B:C Ratio
T_0 - Control	13.84	19.77	49	5.63	112.69	141441	2.68
T_1 - Seed treatment 500 ppm	15.44	23.22	56.51	6.55	130.9	177488	3.1
T_2 - Seed treatment with 1000 ppm	15.96	23.27	58.31	6.71	134.1	183537	3.16
T_3 - Foliar spray with 500 ppm	16.05	23.35	59.07	6.79	135.86	187392	3.22
T_4 - Foliar Spray with 1000 ppm	16.29	23.54	60.89	7	140.04	195413	3.3
T_5 - Seed treatment with 500 ppm + foliar spray with 500 ppm	17.34	24.85	64.64	7.43	148.67	212675	3.51
SEm±	0.44	0.39	0.83	0.13	2.38	7147	0.11
CD at 5%	1.27	1.11	2.38	0.36	6.84	20540	0.35

Table 3. Effect of thiourea on quality attributes of vegetable cowpea

Thiourea treatment combinations	Protein content (%)	Crude fibre content (%)	N content (%)	P content (%)
T_0 - Control	3.4	13.01	0.544	0.056
T_1 - Seed treatment @ 500 ppm	3.756	13.82	0.601	0.066
T_2 - Seed treatment with @ ppm	3.844	13.96	0.615	0.068
T_3 - Foliar spray with @ ppm	3.881	14.06	0.621	0.069
T_4 - Foliar Spray with @ ppm	3.931	14.16	0.629	0.07
T_5 - Seed treatment with 500 ppm + foliar spray with 500 ppm	4.263	15.09	0.682	0.078
SEm±	0.103	0.21	0.017	0.002
CD at 5%	0.296	0.61	0.05	0.006

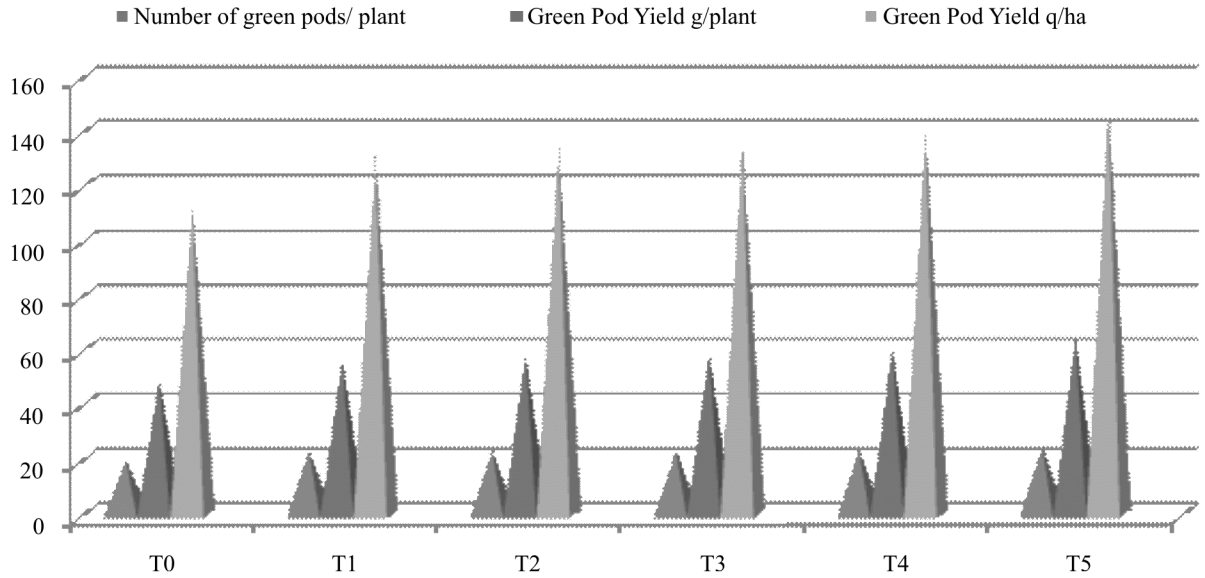

Fig. 1. Effect of thiourea on number of green pods and pod yield of vegetable cowpea

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