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EFFECT OF INTEGRATED FOLIAR NUTRITION ON VEGETATIVE GROWTH OF SUMMER COWPEA (*VIGNA UNGUICULATA* L. WALP.)

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ABSTRACT

A field experiment was conducted to investigate the "Influence of foliar nutrition on yield attributes, yield and economics of summer cowpea (*Vigna unguiculata* L. Walp) in Northern dry Zone of Karnataka" in medium black soils at Krishi Vigyan Kendra (KVK) Farm, Vijayapur during summer 2021. The experiment was laid out in Randomized Complete Block Design with nine treatments replicated thrice. The results revealed that, integrated foliar nutrition through different nutrients exerted significant influence on vegetative growth of summer cowpea. Among them, the treatment combination Recommended package of practice (25:50:25 kg N, P_2O_5 and K_2O per ha) + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% (T_7) at flower initiation stage and peak flowering stage recorded significantly higher plant height (58.56 cm), number of branches (30.37), total dry matter production (25.32 g plant^{-1}), number of nodules plant^{-1} (27.83) and nodule dry weight plant^{-1} (0.86 mg) at 60 DAS. Recommended package of practice (T_9) with no foliar sprays recorded lower plant height (42.83 cm), number of branches (21.33), total dry matter production (17.25g plant^{-1}), number of nodules plant^{-1} (21.70) and nodule dry weight plant^{-1}(0.72 mg).

Key words : Foliar nutrition, Vermiwash, Cowpea, Recommended package of practice.

Introduction

Cowpea (*Vigna unguiculata* L. Walp) is native to Central Africa and belongs to the family Leguminaceae with sub-family Papilionaceae. It is an annual herbaceous plant with large tap root system and alternate trifoliate leaves with ovate leaflets. It can either be short and bushy or act like a vine by climbing supports or trailing along the ground. Cowpea is known as "vegetable meat" or "Poor man's meat" due to high amount of protein in the grain with better biological value on dry weight basis. The grain contains 24.8 per cent protein, 1.9 per cent fat, 63.6 per cent carbohydrates, 6.3 per cent fiber, 0.00074 per cent thiamine, 0.00042 per cent riboflavin and 0.00281 per cent niacin (Boukar *et al.*, 2011). It also has the ability to fix atmospheric nitrogen through its root nodules.

Cowpea has wider adaptability and suits well even in summer and can be grown as a catch crop for increasing system productivity and to maintain fertility status of soil. At present, India is facing two main problems, increasing population and water shortage due to increasing demand for water in all the sectors. Increasing water use efficiency is one of the major goals to increase the production from per unit of water. During summer, crop requires more water and more frequent irrigations (five to six) as compared to *kharif* crop because of high temperature, high evaporative demand and low relative humidity. Scientific irrigation scheduling with understanding of soil-water atmospheric relationship is very important for successful irrigation water management.

Foliar fertilization is an economical way of supplementing the plant nutrients when they are in lack or unavailable in the soil. One advantage of foliar nutrition

is that it often brings about immediate improvement in plant health and growth. Foliar fertilization or foliar feeding entails the supply of nutrients, plant hormones, stimulants and other beneficial substances in liquid form to plant through a real parts of the plants *viz*., leaves and stems and other sites to realize enhanced yield and quality, resistance to pest, improved drought tolerance, and also be used to help the plants in recovery from transplant shock, hail damage or the results of other weather extremes. Fertilizer applied to the soil at the time of sowing is not fully available to the plants as the crop approaches maturity. Supplemental foliar application is one of the many techniques. Application of nutrients through foliar spray at appropriate stages of growth becomes important for their utilization and better performance of the crop (Anadhakrishnaveni *et al*., 2004). Foliar application is also less likely to result in ground water pollution. Under conditions where nutrient supply to plants become a limiting factor because of soil properties, foliar spray helps in optimal supply of nutrients to plant (Naik *et al*., 2018).

Materials and Methods

A field experiment was conducted during summer 2021 at Krishi Vignana Kendra farm, Vijayapur, Karnataka, on vertisol having pH 8.24 and EC 0.32 dS m^{-1}. The soil was medium in organic carbon content (0.51%), low in available N (224 kg ha^{-1}) and high in available P_2O_5 (32 kg ha^{-1}), K_2O content (425 kg ha^{-1}). The experimental site was located at latitude of 16^0 46' 10" North and longitude of 75^0 44' 53" East with an altitude of 594 meters above mean sea level in the Northern Dry Zone of Karnataka (Zone 3). The cowpea variety used for this experiment was DC-15.

The experiment was laid out in randomized complete block design with three replications. The experiment consisted of nine treatments *viz*., T_1: RPP, T_2: RPP + Vermiwash @ 10%, T_3: RPP + Cow urine @ 10%, T_4: RPP + Pulse magic @ 1%, T_5: RPP + 19:19:19 @ 1%, T_6: RPP + Urea @ 2%, T_7: RPP + 19:19:19 @ 1% + Vermiwash @ 10%, T_8: RPP + 19:19:19 @ 1% + Cow urine @ 10%, T_9: RPP + 19:19:19 @ 1% + Pulse magic @ 1%. Including the foliar application of different nutrients at flower initiation and peak flowering stage (two common sprays). The land was ploughed once after the harvest of the previous crop, followed by two harrowings. At the time of sowing, the land was prepared to a fine seedbed and the plots were laid out. The fertilizer application was followed on the basis of the plant population occupied by crop. The nutrients *viz*., nitrogen (25 kg ha^{-1}), phosphorus (50 kg ha^{-1}), potassium (25 kg ha^{-1}) and sulphur (20 kg ha^{-1}) were applied in the form of urea, diammonium phosphate and gypsum respectively, along with zinc sulphate (25 kg ha^{-1}) and FYM (5 t ha^{-1}). Entire quantities of fertilizers were applied to the crops at the time of sowing as basal dose only. The fertilizers were placed in furrows opened at 5 cm away from the seed line (crop row) and manually covered with soil. The data collected from the experiment at different growth stages and were subjected to statistical analysis as described by Gomez and Gomez (1984). After the establishment of plants, five representative plants were selected and tagged at random from the net plot area of each plot for studying all the individual plant characters in the present study. The details of the procedure followed for recording different observations are presented:

Plant height (cm)

It was measured using a metric scale at 30 and 60 days after sowing (DAS) as a vertical distance from the ground level to the tip of the plant on five randomly selected tagged plants in each treatment and the mean value was worked out and expressed in centimeter.

Number of branches plant^{-1}

The branches arising from the main stem was counted on five tagged plants in each treatment of the crop at 30 and 60 DAS and the mean was worked out and expressed as number of branches per plant.

Total dry matter production (g)

Five plants from each plot were selected randomly and uprooted at 30 and 60 DAS. Roots were detached from aerial part of the palnt then samples were kept separately in paper bags in an oven at 70^0 C. After 48 hrs reaching at constant dry weight, each sample was weighed by using electrical balance and average dry matter accumulation per plant was caculated.

Number of nodules plant^{-1} and nodule dry weight (mg)

Number of nodules of five plants was carefully excavated along with the soil of the root zone from each plot at 60 DAS. These nodules were detached and oven dried at 70°C for 48 hours and dry weight was noted in microgram.

Results and Discussion

Growth parameters

The data on growth parameters of summer cowpea at different growth stages [30 and 60 days after sowing (DAS)] as influenced by integrated foliar nutrition are presented in Tables 1, 2 and Fig. 1. At 30 days after sowing (DAS), the plant height, number of branches and total dry matter production of cowpea did not differ

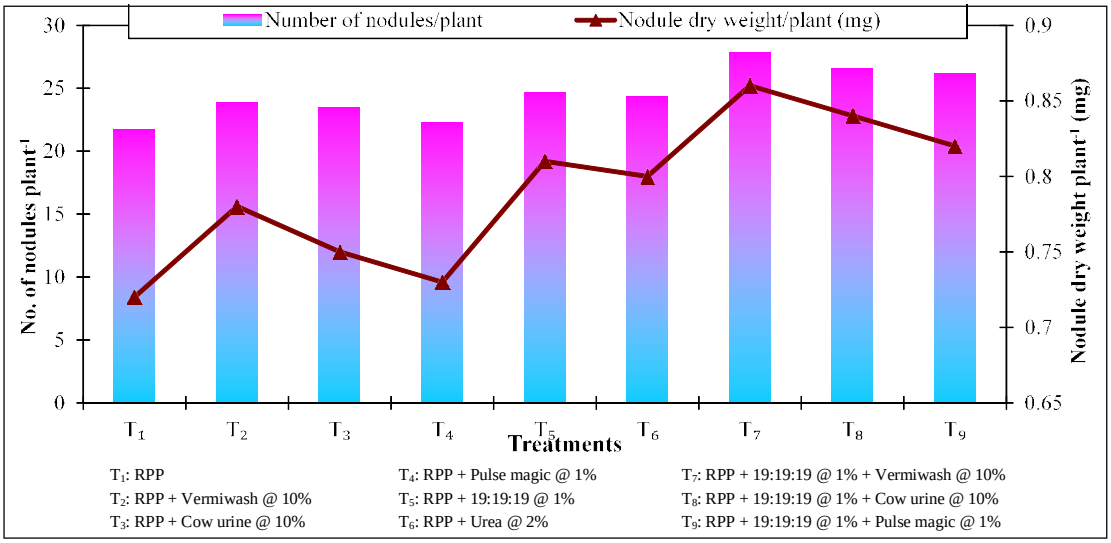

Fig. 1 : Number of nodules and nodule dry weight plant^{-1} at 60 DAS of cowpea as influenced by integrated foliar nutrition.

Table 1 : Influence of integrated foliar nutrition on plant height and number of branches of summer cowpea.

Treatment	Plant height (cm)		Number of branches per plant	
	30 DAS	60 DAS	30 DAS	60 DAS
T_1: RPP	12.47	42.83	5.33	21.33
T_2: RPP + Vermiwash @ 10%	13.18	46.81	5.76	24.83
T_3: RPP + Cow urine @ 10%	12.73	45.27	5.42	23.92
T_4: RPP + Pulse magic @ 1%	13.80	44.25	5.95	23.34
T_5: RPP + 19:19:19 @ 1%	13.52	48.38	5.30	25.61
T_6: RPP + Urea @ 2%	13.26	47.90	5.64	25.07
T_7: RPP + 19:19:19 @ 1% + Vermiwash @ 10%	12.33	58.56	6.12	30.37
T_8: RPP + 19:19:19 @ 1% + Cow urine @ 10%	13.82	55.43	6.34	28.69
T_9: RPP + 19:19:19 @ 1% + Pulse magic @ 1%	13.67	52.51	6.87	27.83
S.Em ±	0.73	2.69	0.33	1.45
C.D. (P=0.05)	NS	8.07	NS	4.36

RPP-Recommended package of practice, **DAS**-Days after sowing, **NS**-Non Significant.

significantly, as no foliar application was done up to flowering stage. The data presented in Tables 1, 2 and Fig. 1 reveals that the contribution of integrated foliar nutrition for vegetative growth on summer cowpea. In the present investigationat 60 DAS *i.e.* vegetative growth, the growth parameters like plant height (58.56 cm), number of branches (30.37), total dry matter production (25.32 g plant^{-1}), number of nodules plant^{-1} (27.83) and nodule dry weight plant^{-1} (0.86 mg) differed significantly with the influence of integrated foliar application. The treatment which received RPP + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% (T_7) at flower initiation and peak flowering stage was registered significantly higher growth parameters due to foliar spray after 30 DAS and which was on par with those of treatments RPP + 19:19:19 @ 1% + Cow urine @ 10% (T_8) and RPP + 19:19:19 @ 1% + Pulse magic @ 1% (T_9). Whereas, significantly lower plant height, number of branches, total dry matter production, number of nodules plant^{-1} and nodule dry weight plant^{-1} was recorded in recommended Package of Practice (T_1) of 42.83 cm, 21.33, 17.25 g plant^{-1}, 21.70 and 0.72 mg, respectively.

This might be due to a significant increase in growth attributes at 60 DAS as the foliar application was started at flower initiation (45 DAS) and peak flowering stage (65 DAS). Application of RPP + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% recorded significantly higher plant height, the higher number of branches, number of nodules, nodule dry weight and lower plant height, lower number of branches value were recorded in recommended Package of Practices. These increased growth attributes might be due to an additional supply of nutrients through the foliar application, which might have increased nutrient

Table 2 : Influence of integrated foliar nutrition on total dry matter production, number of nodules plant^{-1} and nodule dry weight plant^{-1} of summer cowpea.

Treatment	Total dry matter production (g plant^{-1})		Number of nodules plant^{-1}	Nodule dry weight plant^{-1} (mg)
	30 DAS	60 DAS	60 DAS	60 DAS
T_1: RPP	1.90	17.25	21.70	0.72
T_2: RPP + Vermiwash @ 10%	2.20	19.63	23.89	0.78
T_3: RPP + Cow urine @ 10%	2.11	18.32	23.44	0.75
T_4: RPP + Pulse magic @ 1%	2.07	18.15	22.29	0.73
T_5: RPP + 19:19:19 @ 1%	2.39	20.45	24.68	0.81
T_6: RPP + Urea @ 2%	2.33	20.02	24.32	0.80
T_7: RPP + 19:19:19 @ 1% + Vermiwash @ 10%	2.76	25.32	27.83	0.86
T_8: RPP + 19:19:19 @ 1% + Cow urine @ 10%	2.58	23.93	26.55	0.84
T_9: RPP + 19:19:19 @ 1% + Pulse magic @ 1%	2.43	22.42	26.17	0.82
S.Em ±	0.16	1.41	1.19	0.03
C.D. (P = 0.05)	NS	4.22	3.58	0.087

RPP-Recommended package of practice, **DAS**-Days after sowing, **NS**-Non Significant.

uptake and better translocation of nutrients. Similar results were reported by Govindan and Thirumurugan (2000) they observed the growth and yield parameters of green gram, which improved with combined foliar application of 1.0 per cent KNO_3 and KCl compared to the individual application. Subramani and Solaimalai (2000) reported higher growth parameters in green gram with foliar application of 1.0 per cent DAP plus 0.5 per cent urea. Fulvic acid application as a foliar spray increase chlorophyll production and more photosynthates accumulation will be possible (Abdel Baky *et al.*, 2019). Liu *et al*. (1998) reported that humic acid application enhanced nutrient uptake and production of more number of branches per plant.

The increased yield attributes with RPP + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% was also due to significantly higher total dry matter production (25.32 g plant^{-1} at 60 DAS). The lower dry matter production was total dry matter with recommended Package of Practices (17.25 g plant^{-1}). Increased dry matter distribution in different parts and total dry matter accumulation at different growth stages was mainly due to additional nitrogen supplied through foliar nutrition helped in maintaining higher auxin level which might have resulted in increased uptake of nutrients which in turn helped in increased plant height, number of branches and also which enhanced development of root which increased uptake of nutrients this might have contributed for better plant growth and ultimately increased the dry matter production and also increased nodule count with enhanced nodule dry weight (Maheshwari *et al*., 2016). These results are in conformity with the findings of Anbumani *et al*. (2003) they reported that the application of foliar nutrients facilitated more availability and less interference in the absorption of nutrients. This paves the way for the production of more biomass leading to higher dry matter accumulation. Vemaraju (2014) suggested that *jeevamrutha* application enhanced the total dry matter production in oriental pickling melon.

Conclusion

Based on the investigation results, it was concluded that growing of cowpea in summer with foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% along with RPP (25:50:25 kg N, P_2O_5 and K_2O per ha) was found superior over the other treatments which resulted in higher vegetative growth compared to other treatments.

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