The Pharma Innovation Journal 2022; 11(12): 1586-1591

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 1586-1591

www.thepharmajournal.com
Received: 01-09-2022
Accepted: 06-10-2022

BB Jaybhaye
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, Maharashtra, India

Dr. VG Takankhar
Associate Professor, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, Maharashtra, India

NP Asati
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Manoharbhai Patel College of Agriculture, Hiratola, Gondia, Maharashtra, India

VS Bodke
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, Maharashtra, India

PK Pidurkar
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, Maharashtra, India

Corresponding Author:
BB Jaybhaye
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Latur, Maharashtra, India

Effect of foliar application of water soluble fertilizers on growth, nitrogen uptake and soil available nutrients of black gram (*Vigna mungo* L.)

BB Jaybhaye, Dr. VG Takankhar, NP Asati, VS Bodke and PK Pidurkar

Abstract
The field experiment was carried out on "Studies on effect of foliar application of water soluble fertilizers on growth and available nutrient of black gram" during *kharif* 2020- 2021 at College of Agriculture, Latur. The experiment was laid out in randomized block design with nine treatments and three replications. The growth and uptake of nutrient attributes of black gram were significantly influenced due to foliar application of black gram. The treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively), recorded significantly increased plant height, number of branches plant^{-1} (8.98) and number nodules plant^{-1} (22.33), leaf area (680 cm^2) and leaf area index (2.27), over rest of treatments. of black gram increased significantly due to the treatment foliar application of 19:19:19 @ 0.5%, 0:52:34 @ and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively along with RDF. The pH, EC and calcium carbonate content in experimental soil was not significant due to different treatment of soluble fertilizers. However, organic carbon content in soil was significantly improved due to treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively). Significantly highest uptake of N (54.81 kg ha^{-1}), P (6.86 kg ha^{-1}) and K (25.44 kg ha^{-1}) in seed and straw of black gram were recorded due to treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively).

Keywords: Water soluble fertilizers, growth, nutrient uptake, organic carbon and available nutrient

Introduction
Black gram or urad bean [*Vigna mungo* L.] is a major pulse crop in India, belong to the leguminaceae. India is said to be the origin of black gram and it has been cultivated in India since ancient times. It can be boiled or eaten whole, ground into flour and used to make porridge or baked into bread and biscuits. Green pods are also edible South in India most popular food preparation *viz.* idly and dosa are prepared by mixing rice and black gram flour. It is the chief constituent of 'papad' and also of 'bari'. Black gram contains a 24% protein, 60% carbohydrates, 1.3% fat. It is high in vitamins A, B_1, and B_3, and contains trace amount of thiamine, riboflavin, niacin, and vitamin C. It includes between 78 and 80% nitrogen in the form of albumin and globulin. The mineral composition includes calcium (286 mg), iron (15.67 mg), magnesium (553 mg), phosphorus (785 mg), potassium (2035 mg), sodium (79 mg), zinc (6.93 mg), copper (2.031 mg), manganese (3.161 mg), protein (52.18g) and Vitamins like Vit A (2.141 mg), C (2.62 mg), B_1 (0.273 mg), B_2 (0.254 mg), B_3 (1.447 mg), B_6 (0.906 mg), B_9 (0.281 mg), B_{12} (216 mg) and vitamin B_{15} (0.906 mg) (Swaminathan *et al.*, 2020) [8]. Black gram contains 348 calories per 100 gram. As a result, it is the most affordable source of protein for the poor and vegetarians. Dal-chawal (pulse-rice) or dal-roti (pulse-wheat bread) is an important component of the normal Indian diet. However, because it is an essential source of human food, it is also utilized as nutritious fodder, particularly for milch animals. Black gram is also used to treat diabetes, sexual dysfunction, neurological problems, hair disorders, digestive system abnormalities, and rheumatic illnesses. It is prized for its ease of digestion. Growing black gram itself is a mini-fertilizer factory because it has unique characteristics of maintaining and restoring soil fertility through fixing atmospheric nitrogen in symbiotic association with *rhizobium* bacteria present in root nodules. It is used as a nutritive fodder especially for milch animals. (Tiwari and Shivhare, (2016) [11] and also used as a green manure crop. It possesses very good root system which binds soil particles and thus prevents soil erosion. It proved to be an excellent rotation

crop, increasing the production of the primary crop as well. It is primarily grown in a cereal-pulse cropping system to save soil nutrients and utilize left-over soil moisture, particularly following rice production. It is a short-season pulse crop, usually flowering within 30-60 days of sowing and ripening within 60-90 days. It is typically grown as a *kharif* crop, although it also works well as a catch crop in the summer. Foliar application of nutrients is preferable to soil application since it requires less fertilizer. Fertilizer prices are increasing on a daily basis, so it is vital to cut Fertilizers costs by using foliar fertilizer application to boost legume crop production. During the last three years, Maharashtra has a persistent dry spell lasting 15 to 35 days during the *kharif* season. It has a negative impact on the growth and yield of *kharif* crops. According to the research, foliar nutrition with N, P and K helps increase drought resistance in plants and lowers water loss through evapo-transpiration. The greater advantage in supplying the N, P and K as foliar spray was observed in many pulse crops by considering significantly foliar fertilization with major nutrients through water soluble fertilizer on pulse crop like black gram. Very vigor work was carried out in this regard hence it is necessary to conduct present investigation entitled "Studies on effect of foliar application of water soluble fertilizers on growth and yield of black gram

Materials and Methods

The experiment was carried out at department of SSAC Research Field, College of Agriculture, and Latur during *kharif* season 2020-2021 on black gram variety TAU-1. The details of the material used to "studies on effect of foliar application of water soluble fertilizers on growth and uptake of black gram". Randomized Block Design (RBD) was followed with 9 treatments each replicated thrice. The treatment details are [T_1 – Control, T_2 - RDF (25:50:00), T_3 - RDF+ FS 19:19:19 @ 0.5% at 25 DAS, T_4 - RDF + FS 00:52:34 @ 1% at 35 DAS, T_5 - RDF+ FS 13:00:45 @ 1% at 45 DAS, T_6 - RDF+ T_3 + T_4, T_7 - RDF +FS T_4 + T_5, T_8 - RDF + FS T_3 + T_5, T_9 - RDF+ FS T_3 + T_4 + T_5]. The experiment was laid out in Randomized Block Design with three replications. The size of each plot treatment was 3 m x 2.7 m. There are four factors which are Recommended Dose of Fertilizers (25:50:00), Foliar spray (19:19:19), Foliar Spray (00:52:34), Foliar Spray (13:00:45). The variety TAU-1of black gram was sown on 7th July 2021 by maintaining a spacing of 30×10 cm^2. The growth parameters were plant height, number of leaves per plant, number of branches per plant, root nodules, uptake of nutrient and chemical analysis of soil available nutrients. The results were statistically analyzed as per the "statistical methods for Agricultural workers" by Panse and Sukhatme (1985) [7].

Results and Discussion

Effect of foliar application of water soluble fertilizers on biometric observations of black gram.

Plant height

Plant height was measured at different stages *i.e.* 30, 45 and at 60 DAS. The data regarding plant height is presented in table 1and showed that plant height was affected significantly due to foliar application of water soluble fertilizers at 30, 45 and 60 DAS. The treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ 1.0% and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively) increased plant height significantly at 30 (29.73 cm), 45(50.40 cm), and at 60 DAS (53.11 cm) over the rest of treatment. However, the treatments T_6, T_7 and T_8 were at par with each other. Similarly the treatments T_2, T_4, and T_5 were at par with each other. Significantly lowest plant height was recorded in control (16.52 cm) treatment at all the growth stages except at 30 DAS. This rise in plant height could be attributed due to foliar nutrition with water soluble fertilizers, which aids in the acceleration of several metabolic processes, resulting in increased apical growth. Similar results were also reported by, Singh *et al* (2021) [7], which revealed that the growth attributes such as plant height (60.28 cm) was maximum with 75% RDF + foliar application of 2% DAP + 2% urea +2% WSF.

Table 1: Effect of foliar application of water soluble fertilizers on plant height (cm) of black gram

Treatment	Mean plant height (cm)		
	30 DAS	45 DAS	60 DAS
T_1:Control	16.52	32.0	34.76
T_2:RDF (25:50:00)	19.15	35.20	38.60
T_3:RDF+ FS 19:19:19 @ 0.5% at 25 DAS	21.79	38.40	42.75
T_4:RDF + FS 00:52:34 @ 1% at 35 DAS	19.28	36.4	41.59
T_5:RDF+ FS 13:00:45 @ 1% at 45 DAS	19.67	37.1	41.62
T_6:RDF+ T_3 + T_4	26.16	46.7	46.09
T_7: RDF + T_4 + T_5	25.87	46.9	46.56
T_8: RDF +T_3 + T_5	26.94	47.0	48.55
T_9: RDF+ T_3 + T_4 + T_5	29.73	50.4	53.11
S.Em ±	0.88	1.06	1.25
CD at 5%	2.63	3.19	3.74

Number of leaves plant per plant

The number of leaves plant $^{-1}$ were counted at 30, 45 and 60 DAS and the data is presented in table 2 and significantly influenced due to foliar application of water soluble fertilizers. The treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ 1.0% and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively), increased number of leaves plant^{-1} significantly at 30, (20.91), 45(35.71), and 60 DAS (6.84) over the rest of treatment. However the treatments T_2, T_4, T_5 and T_7 were at par with each other at 30 DAS. and the treatments T_6, T_7, and T_8 were at par with each other at 45 DAS & at 60 DAS Significantly lowest number of leaves plant $^{-1}$ were recorded in control at all growth stages *i.e.*, 30(10.33), 45 (15.67) and at 60 (3.58) DAS. Further data revealed that the number of leaves plant $^{-1}$ were decreased drastically at 60 DAS, it might be due to shedding of leaves at maturity. The higher number of leaves plant $^{-1}$ might be due to improvement in morphological characters like plant height and number of branches led to more of leaves. Additional application of nitrogen through from foliar application influenced vegetative growth in plant and reduced fertilizer loss resulted in higher number of leaves plant^{-1}. These results were in collaboration with Koneni (2016) [4] that the soil application of 50 kg P_2O_5 ha^{-1} along with foliar application of BOOST-52 (0:52:34) at 30 and 45 DAS recorded significantly higher number of functional leaves (6.35plant^{-1}).

Table 2: Effect of foliar application of water soluble fertilizers on number of leaves plants^{-1} of black gram

Treatment	Mean of No of leaves plant^{-1}		
	30 DAS	45 DAS	60 DAS
T_1: Control	10.33	15.67	3.58
T_2: RDF (25:50:00)	12.26	21.39	3.74
T_3: RDF+ FS 19:19:19 @ 0.5% at 25 DAS	14.17	27.07	3.90
T_4: RDF + FS 00:52:34 @ 1% at 35 DAS	13.54	26.67	4.05
T_5: RDF+ FS 13:00:45 @ 1% at 45 DAS	13.13	26.00	4.10
T_6: RDF+ T_3 + T_4	18.32	31.99	6.65
T_7: RDF + T_4 + T_5	13.47	30.21	6.68
T_8: RDF + T_3 + T_5	16.40	31.47	6.70
T_9: RDF+ T_3 + T_4 + T_5	20.91	35.77	6.84
S.Em±	0.63	1.03	0.03
CD at 5%	1.89	3.10	0.10

No. of branches per plant

Branching is the important character of crops which bears the pods plant^{-1} and ultimately enhanced the yield of crop. The data regarding effect of foliar application of water soluble fertilizers on mean number of branches plant^{-1} at stages *i.e.* 30, 45 and 60 DAS were presented in table 3 and result that the number of branches plant^{-1} in black gram was influenced due to foliar application of water soluble fertilizers. The significantly highest number of branches plant^{-1} were observed with treatment T_9: (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively), The treatment T_9 recorded significantly higher number of branches plant $^{-1}$ at 30 DAS (6.33), 45 DAS (8.98), and 60 DAS (8.27) over the rest of the treatments. Significantly lowest number of branches plant^{-1} was observed in control treatment T_1 at the 30 DAS (3.26), 45 DAS (4.22), and 60 DAS (3.54). Among treatment differences T_6, T_7, and T_8 were at par with each other in case of mean number of branches plant^{-1} at stages of black gram. The higher number of branches plant^{-1} might be due to hastening various metabolic process *viz.*, photosynthesis, symbiotic biological N_2 fixation process and higher nutrient availability at the initial stage of the crop. Similar result findings with Takankhar *et al.* (2017) [9] conducted field study and indicated that number of branches plant^{-1} (6.00), dry matter of chickpea (6.11 g) were significantly improved due to treatment T_8 (RDF + 19:19:19 @ 1.0% at vegetative stage, RDF+ 00:52: 34 @ 1.0% at flowering stage and RDF + 13:00:45 @ 1.0% at grain filling stage).

Table 3: Effect of foliar application of water soluble fertilizers on number of branches plant^{-1} in black gram

Treatment	Mean Number of branches plant^{-1}		
	30 DAS	45 DAS	60 DAS
T_1: Control	3.26	4.22	3.54
T_2: RDF (25:50:00)	4.11	5.89	4.85
T_3: RDF+ FS 19:19:19 @ 0.5% at 25 DAS	5.08	6.91	6.16
T_4: RDF + FS 00:52:34 @ 1% at 35 DAS	4.80	6.08	4.57
T_5: RDF+ FS 13:00:45 @ 1% at 45 DAS	4.75	6.11	4.40
T_6: RDF+ T_3 + T_4	5.73	7.76	7.09
T_7: RDF + T_4 + T_5	5.77	7.69	7.26
T_8: RDF +T_3 + T_5	5.74	7.66	7.25
T_9: RDF+T_3 + T_4 + T_5	6.33	8.98	8.27
S.Em±	0.05	0.28	0.18
CD at 5%	0.17	0.83	0.53

Root nodules

The data on number of root nodules plant^{-1} at different stages *i.e.* 30 and 45 DAS, as influenced by foliar application of water soluble fertilizers is presented in table 4. The numbers of nodules plant-1 were significantly influenced by different treatments of water soluble fertilizers in black gram. Results showed that the significantly highest number of root nodules plant $^{-1}$ were observed with the treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 @ 1.0% and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively), at 30 DAS (21.13) & 45 DAS (22.33) over the rest of the Treatments. Among the different treatments T_3, T_4, and T_5, were at par with each other. Similarly the treatment T_6, T_7 and T_8 were also at par with each other in case of number of root nodules at 30 DAS & 45 DAS. However, significantly lowest root nodules were observed in control treatment T_1 9.60 & 12.27 at 30, 45 DAS, respectively. Similar results were also reported Bhavya *et al.* (2020) [2] showed that foliar application of mono-potassium phosphate and 19:19:19 each on green gram @ 1% at 30 and 45 DAS recorded higher number of nodules (36.92) as compare to control.

Table 4: Effect of foliar application of water soluble fertilizers on number of nodules plant^{-1} in black gram

Treatment	Number of nodules plant^{-1}	
	30 DAS	45 DAS
T_1:Control	9.60	12.27
T_2:RDF (25:50:00)	12.30	14.95
T_3:RDF+ FS 19:19:19 @ 0.5% at 25 DAS	13.95	16.82
T_4:RDF + FS 00:52:34 @ 1% at 35 DAS	13.80	17.15
T_5:RDF+ FS 13:00:45 @ 1% at 45 DAS	13.08	17.09
T_6:RDF+ T_3 + T_4	15.74	19.23
T_7: RDF + T_4 + T_5	14.75	19.27
T_8: RDF +T_3 + T_5	16.77	19.40
T_9: RDF+ T_3 + T_4 + T_5	21.13	22.33
S.Em±	0.54	0.61
CD at 5%	1.64	1.83

Effect of foliar application of water soluble fertilizers on content and uptake of nutrient of black gram

Nitrogen uptake by black gram

The data on nitrogen uptake in seed and straw as influenced by foliar application of water soluble fertilizers after harvest of black gram are presented in table 5. It indicated that the foliar application of water soluble fertilizers influenced N uptake in seed (54.81 kg ha^{-1}) and straw (11.16) kg ha^{-1} of black gram crop was also significantly increased due to T_9. Similarly, lowest nitrogen uptake in seed (31.92 kg ha^{-1}) and straw (3.47 kg ha^{-1}) were recorded in control treatment. However in case of nitrogen uptake of cowpea, treatments T_6, T_7 & T_8 were at par with each other. Similar finding were reported by Takankhar *et al.* (2018) [10] reported that foliar application of (RDF + 19:19:19 @ 0.5% at vegetative stage, RDF + 00:52:34 @ 1.0% at flowering stage and RDF + 13:00:45 @ 1.0% at grain filling stage) significantly increased the 'N' uptake in green gram.

Phosphorous uptake by black gram

The P uptake in seed & straw ranged between 2.55 kg ha^{-1} to 6.86 kg ha^{-1} and 2.52 kg ha^{-1} to 8.54 kg ha^{-1} respectively. Similar findings were also recorded treatments T_9 in case of uptake of P in seed and straw of black gram. Significantly highest P uptake in seed (6.86 kg ha^{-1}) and straw (8.54 kg ha^{-1}) of black gram was observed with treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively. This increasing N uptake might be due to increased availability of nitrogen to the crop and higher biomass production with increased photosynthesis. Similar result observed to Waghmare *et al.* (2019) [12], they revealed that application foliar spray of water soluble fertilizer 19:19:19 at 2.0% along with basal dose of (25:40:20 kg N, P_5, K_2O) at flowering and pod development stage recorded significantly, higher uptake of phosphorous (14.6 kg ha$^{-1)}$ in gram.

Potassium uptake by black gram

The K uptake in seed & straw were ranged between 13.76 to 25.44 kg ha^{-1} to 2.80 to 8.54 kg ha^{-1} respectively. Significantly highest K uptake in seed (25.44 kg ha^{-1}) and straw (8.54 kg ha^{-1}) of black gram was recorded with treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively) over the rest of treatments, Whereas the lowest uptake of K in seed (13.76 kg ha^{-1}) and straw (2.80 kg ha^{-1}) were recorded in control. However treatment T_6, T_7 & T_8 were at par with each in case uptake of seed and straw of black gram. This increase in concentration and uptake of K in black gram crop might be due to foliar application of K resulted into greater availability of K through leaves. Similar finding were noted by Bansode and Math (2018) [1] they reported that two foliar sprays of @ 1.0% 19:19:19 recorded significantly higher uptake of potassium (96.87 kg ha^{-1}).

Table 5: Effect of foliar application of water soluble fertilizers on nitrogen uptake (kg ha^{-1}) of nitrogen in seeds and straw of black gram

Treatment	Seed N Uptake (kg ha^{-1})	Straw N Uptake (kg ha^{-1})	Seed P uptake (kg ha^{-1})	Straw P uptake (kg ha^{-1})	Seed K Uptake (kgha^{1})	Straw K Uptake (kgha^{1})
T_1: Control	31.92	3.47	2.55	2.52	13.76	2.80
T_2: RDF (25:50:00)	37.34	5.82	3.44	3.90	17.09	3.62
T_3: RDF+ FS 19:19:19 @ 0.5% at 25 DAS	43.56	6.06	4.42	4.46	19.38	4.47
T_4: RDF + FS 00:52:34 @ 1% at 35 DAS	39.22	6.38	4.37	4.63	18.94	4.63
T_5: RDF+ FS 13:00:45 @ 1% at 45 DAS	39.76	6.58	4.67	4.97	19.84	4.98
T_6: RDF+ T_3 + T_4	49.63	8.87	5.75	7.05	22.25	7.06
T_7: RDF + T_4 + T_5	49.51	9.30	5.88	7.28	22.90	7.28
T_8: RDF +T_3 + T_5	49.27	9.87	6.15	7.61	23.38	7.61
T_9: RDF+T_3 + T_4 + T_5	54.81	11.16	6.86	8.54	25.44	8.54
S.Em±	31.92	3.47	0.39	0.5	0.85	0.56
CD at 5%	37.34	5.82	1.15	1.5	2.55	1.51

Effect of foliar application of water soluble fertilizers on available nutrient content of black gram

Organic carbon

The experimental data on effect of foliar application of water soluble fertilizers on organic carbon content after the harvest of black gram are given in table 6. The data on organic carbon content in soil was significantly affected by various treatments of water soluble fertilizers in black gram. The minimum organic carbon was recorded in control (0.37%) & it was maximum (0.66%) in treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25 and 45 DAS, respectively). The treatment T_9 increased significantly the organic carbon in soil over rest of treatments except T_6 and T_8 were at par. Further it was from the data that remaining all the treatment were at par to each other. The organic matter content of soil rise due to addition of crop residues after the harvest of black gram.

Available Nitrogen

Treatment wise available nitrogen content in the soil was determined after the harvest of black gram crop. It was clear from the results that the various treatments had a significant impact on the amount of soil-available N after the harvest of black gram. Significantly higher available nitrogen was observed in treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively) over the rest of treatments followed by T_8, T_6, T_7. However lowest nitrogen (123.7 kg ha^{-1}) was reported in treatment T_1 control followed by T_2 RDF (132.8 kg ha^{-1}). These result similar were with findings of Patil (2021) revealed that the application of foliar application of combination of different water soluble fertilizers with RNP significantly increased the available N. The maximum available N was recorded in treatment (T9) RNP + foliar application 19:19:19 @ 0.5% + 0:52:34 @ 1.0% + KNO_3 @ 1.0% (172.64 kg ha^{-1}) followed by (T_8) RNP + foliar application 19:19:19 @ 0.5% + KNO_3 @ 1.0% (168.37 kg ha^{-1}) as compare to control (142.48 kg ha^{-1}).

Available Phosphorous

The findings regarding effect of foliar application of water soluble fertilizers on soil phosphorous availability after the harvest of crop were presented in table 6. It was clear from the results that the various experimental treatments did not affected significantly the available phosphorous in soil after the harvest of black gram crop. Available phosphorous in soil was higher 17.3 kg ha^{-1} due to treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, 35 and 45DAS, respectively), followed by T_6, T_4, and T_7. Whereas lowest available phosphorous was observed in treatment T_1 control (14.0 kg ha^{-1}) followed by T_2 RDF (14.5 kg ha^{-1}) Similar findings were also reported by Jadhav S.M. (2017) [3] reported that the foliar application of DAP @ 2% along with RDF + macronutrients showed positive effect of available nutrients in soil.

Available Potassium

The data on effect of foliar application of water soluble fertilizers on available potassium in soil of black gram are presented in table 6. It was clear from the results that the various treatments had no significant effect on the amount of soil-available potassium after the harvest of black gram. Higher available potassium (531.9 kg ha^{-1}) in soil was observed in treatment T_9 (RDF + foliar application of 19:19:19 @ 0.5%, 0:52:34 and 13:00:45 @ 1.0% at 25, and 45 DAS, respectively), followed by T_7, (529.0 kg), T_6 (525.0), T_8 (523.6). Lowest available potassium in soil was observed in treatment T_1 control (510.3 kg ha^{-1}) followed by T_2 (513.03 kg ha^{-1}).

Table 6: Effect of foliar application of water soluble fertilizers on available nutrient after harvest of black gram

Treatment	OC (%)	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
T_1: Control	0.37	123.7	14.0	510.3
T_2: RDF (25:50:00)	0.39	132.8	14.5	513.0
T_3: RDF+ FS 19:19:19 @ 0.5% at 25 DAS	0.51	146.1	15.4	517.1
T_4: RDF + FS 00:52:34 @ 1% at 35 DAS	0.46	148.3	16.7	518.0
T_5: RDF+ FS 13:00:45 @ 1% at 45 DAS	0.45	150.5	16.5	522.2
T_6: RDF+ T_3 + T_4	0.56	157.3	17.0	525.0
T_7: RDF + T_4 + T_5	0.50	156.3	16.5	529.0
T_8: RDF + T_3 + T_5	0.59	164.3	16.3	523.6
T_9: RDF+T_3 + T_4 + T_5	0.66	174.7	17.3	531.9
S.Em±	0.06	2.40	-	-
CD at 5%	0.17	7.47	N.S	N.S

Conclusion

The growth attributes like growth of black gram were increased significantly due to foliar application of 19:19:19 @ 0.5%, 0:52:34 @ % 1.0 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively along with RDF. The highest uptake of nitrogen (54.81 kg ha^{-1}) were recorded with foliar application of 19:19:19 @ 0.5%, 0:52:34 @ % 1.0 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively along with RDF the calcium carbonate in soil was not significantly affected due to foliar application of water soluble fertilizers whereas, organic carbon was increased significantly due to foliar application of water soluble fertilizers on black gram. Available nutrients in soil after harvest of crop were increased significantly due to foliar application of 19:19:19 @ 0.5%, 0:52:34 @ % 1.0 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively along with RDF in black gram. From the above results it can be concluded that foliar application of 19:19:19 @ 0.5%, 0:52:34 @ % 1.0 and 13:00:45 @ 1.0% at 25, 35 and 45 DAS, respectively along with RDF was found more effective in increasing the growth, nutrient uptake and available nutrient status of soil in black gram.

References

1. Bansode C, Math KK. Effect of foliar feeding of 19:19:19 and potassium nitrate water soluble fertilizers on major nutrient status of soybean in a vertisol.

International Journal of Chemical Studies. 2018;6(3):2251-2253.
2. Bhavya M, Shridhara CJ, Nandish MS, Mavarkar NS, Suchita Y, Sumitra BS. Influence of foliar application of water soluble fertilizers on nodule count and rhizosphere microbial population in green gram. International Journal of Current Microbiology and Applied Sciences. 2020;9(2):2383-2392.
3. Jadhav SM. Studies on foliar nutrition in black gram rainfed condition (Master's Thesis). Vasantrao Naik Marathawada Krishi Vidyapeeth Parbhani; c2017.
4. Koneni S. Effect of soil and foliar application of phosphorous on growth of green gram (*Vigna radiata* L.) Trends in Biosciences. 2016;9(1):0974-8431.
5. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication; c1985. p. 87-89.
6. Patil PR. Influence of foliar application of water soluble fertilizers on nutrient dnyanamics, quality and yield of cow pe*a.* (Master's Thesis) Vasantrao Naik Marathawada Krishi Vidyapeeth Parbhani; c2021.
7. Singh K, Kumar S, Kaur C. Effect of foliar application of water soluble fertilizers on growth and yield of chickpea. Indian Journal of Agriculture Research. 2021;66(5):639-642.
8. Swaminathan C, Surya R, Subramanian E, Arunachalam P. Challenges in pulses productivity and agronomic opportunities for enhancing growth and yield in blackgram (*Vigna mungo* (L.) Hepper). Legume Research. 2020;1(9):4357.
9. Takankhar VG, Karanjikar PN, Bhoye SR. Effect of foliar nutrition on growth, yield and quality of chick pea. An Asian Journal of Soil Science. 2017;12(2):216-219.
10. Takankhar VG, Padghan AD, Lokhande AD, Patil NM, Aundhakar AV. Effect of foliar application of macronutrients (N, P and K) on nutrient uptake in different growth stages of green Gram. International Journal of Engineering Science and Computing. 2018;8(7):18654-18657.
11. Tiwari AK, Shivhare A. Pulses in India restropect and prospect. Director, Govt. of India, Ministry of Agri. & Farmers Welfare (DAC & FW), Directorate of Pulses Development, Vindhyachal Bhavan, Bhopal M.P. 2016;23:25.
12. Waghmare YV, Thaokar AC, Gawali KA, Nagote AV. Sarda A. Impact of foliar application of water soluble NPK fertilizers on yield, nutrient uptake and quality of gram. Journal of Pharmacognosy and Phytochemistry. 2019; 8(5):290-292.