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Effect of Sulphur Application with Organic Foliar Nutrition on Growth Attributes of Irrigated Blackgram

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ABSTRACT

Field investigation was carried out to study the effect of sulphur application with organic foliar nutrition on growth attributes of irrigated blackgram at Periyankunam village, Bhuvanagiri taluk, during March–May, 2018. The experiment was laid out in split plot design and replicate thrice with different nutrient levels viz., M₁ - RDF (25:50:0 NPK kg ha⁻¹) + no sulphur application, M₂ - RDF (25:50:0 NPK kg ha⁻¹) + soil application of sulphur @ 10 kg ha⁻¹, M₃ - RDF (25:50:0 NPK kg ha⁻¹) + soil application of sulphur @ 20 kg ha⁻¹ as the main plot treatments and foliar spray as the sub plot treatments viz., S₁ - 2 per cent DAP application, S₂ - 3 per cent panchagavya application, S₃ - 3 per cent nitrobenzene application, S₄ - 3 per cent seaweed extract application and S₅ - 2 per cent vermiwash application on 30th and 45th DAS were allocated. A popular blackgram variety Cv. ADT 5 was chosen for the study. The result indicated that RDF + soil application of sulphur (20 kg ha⁻¹) coupled with foliar application of three per cent seaweed extract at 30 and 45 DAS (M₃S₄) excelled all other treatments by recording higher growth components viz., plant height, leaf area index and dry matter production.

Key words: Blackgram, Sulphur, Panchagavya, Seaweed extract, Nitrobenzene, Vermiwash

Pulses are the richest source of protein for the majority of the population of our country. Pulses are cheaper source of protein than meat hence they are often referred as "poor man's meat" in the developing countries. Pulses are an important group of food crops that can play a vital role to address national food and nutritional security and also tackle environmental challenges. As a restorative crop of soil fertility, pulses have a unique position in cropping systems of wet land, dry land or rainfed agriculture. These are drought resistant and prevent soil erosion due to their deep root system and good coverage, because of these good characters pulses are called as "Marvel of Nature". The United Nations declared 2016 as "International Year of Pulses" (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition.

Black gram (*Vigna mungo* L.) also known as "Urad" is one of the most important pulse crops grown all over India.

India accounts for 70 per cent of black gram production in the world. The potential of black gram is very low due to various physiological, biochemical as well as inherent factors associated with the crops [1]. The productivity of pulses in our country including black gram is not sufficient to meet the domestic demand of the population. Hence, there is need for enhancement of the productivity of black gram by proper agronomic practices. Chemically grown foods have adversely affected human health. Organic formulations could be a potent source to improve crop productivity and quality and additionally control of pest and diseases. Foliar spray is a technique of feeding plants by applying liquid formulations directly to their leaves. Sulphur is recognized as the fourth major plant nutrient after nitrogen, phosphorus and potassium in all the crops. Sulphur deficiency is increasingly becoming one of the limiting factors to further sustainable increase in agricultural production. Sulphur fertilizer, besides enhancing growth, yield and quality of crops, enhances nutrient uptake, particularly N, and fertilizer-use efficiency through interaction of Sulphur with other fertilizer nutrients [2].

Application of phosphorus through di ammonium phosphate increased photosynthesis activity of plant and helps to develop a more extensive root system and thus enables the plant to extract more water and nutrient from soil depth, resulting in better development of plant growth. It plays a key role in various physiological processes viz., root growth and dry matter production, nodulation, and nitrogen fixation and in metabolic activities especially in protein synthesis [3]. Panchagavya has played a significant role in providing

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resistance to pests and diseases. The use of Panchagavya results in higher growth, yield and quality of crops [4]. Plant growth substances present in Panchagavya helps to bring rapid changes in phenotypes of plants and improves the growth and ultimately improves the productivity of the crops. Nitrobenzene is quickly absorbed into the plants, which has capacity to increase flowering in plants. Nitrobenzene stimulates cell elongation and enhances the plant canopy and increases the yield of many crops [5].

Liquid fertilizers derived from seaweeds are found to be superior to chemical fertilizers due to high level of beneficial compounds that useful for plant growth and development. Seaweed extract is natural organic fertilizers which is highly effective nutrient and promotes maximum growth, quick germination of seeds and ability of resistance of many crops [6]. Verm wash can be used as a potent biofertilizer to improve the germination and seedling survival rates in crop plants growing on nutrition depleted soils thus paving the way for sustainable agriculture using organic farming practices [7]. Verm wash increases the disease resistant power of crops. Considering the above facts, field experiment was carried out at Periyankunnam village to study the effect of Sulphur application with organic foliar nutrition on growth attributes of irrigated black gram.

MATERIALS AND METHODS

The field experimental was conducted to study the effect of Sulphur application with organic foliar nutrition on growth attributes of irrigated black gram at Periyankunnam village, Bhuvanagiri taluk, during March-May 2018. The experimental field is situated at 11° 28' N latitude, 79° 37' E longitude and at an altitude of +44 m above the mean sea level. The weather at Periyankunnam is moderately warm with hot summer months. The maximum temperature ranges from 34.28°C to 39.71°C with a mean of 37.60°C. The minimum temperature ranges from 21.00°C to 27.42°C with a mean of 25.39°C. The relative humidity ranges from 79 to 89 per cent with a mean of 84.09 per cent, and the average rainfall is 2.51 mm. The soil of the experimental field was clay loam. The soil was low in available nitrogen, medium in available phosphorous and high in available potassium. The experiment was laid out in split plot design with three replications. A popular black gram variety Cv. ADT 5 was chosen for the study. The main treatment comprised of RDF (25:50:0 NPK kg ha⁻¹) + no Sulphur application (M₁), RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 10 kg ha⁻¹ (M₂), RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ (M₃). The sub treatment comprised of foliar application of 2 per cent DAP (S₁), foliar application of 3 per cent Panchagavya (S₂), foliar application of 3 per cent nitrobenzene (S₃), foliar application of 3 per cent seaweed extract (S₄) and foliar application of 2 per cent Verm wash (S₅) on 30 and 45 DAS respectively.

The nitrogen content in the crop samples were estimated by Microkjeldhal method as suggested by Yoshida *et al.* [8]. The phosphorus content was estimated by using triple acid digestion method as described by Jackson [9] with photoelectric calorimeter. From the standard curve drawn, the phosphorus content in the crop was calculated and expressed in kg. ha⁻¹. The potassium content of the crop sample was estimated by using triple acid extract method as described by Jackson [9] using flame photometer. The potassium content of sample was calculated from the standard curve drawn and expressed in kg ha⁻¹.

RESULTS AND DISCUSSION

Effect on plant height

The data presented in (Table 1) revealed that application of RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ (M₃) recorded the highest plant height of 26.00, 37.01, 41.92 cm at 30, 45 DAS and at harvest respectively. The increased plant height might be due to the favorable effects of Sulphur on N-metabolism and consequently on the vegetative growth of black gram [10]. Among the sub-plot treatments, the highest plant height were observed in foliar spray of 3 per cent seaweed extract @ 30 and 45 DAS (S₄) of 23.02, 34.00 and 38.81 cm at 30, 45 DAS and at harvest, respectively (Table 1). The increased growth parameters due to enhancement of the availability of nutrients and production of growth promoting substances that might have caused cell elongation and multiplication of leaves due to foliar spray of liquid fertilizers [11]. The interaction effects were also found to be significant with RDF (25:50:0 NPK kg ha⁻¹) + sulphur application (20 kg ha⁻¹) coupled with 3 per cent seaweed extract foliar spray @ 30 and 45 DAS (M₃S₄) and recorded the highest value regarding plant height at 30, 45 DAS and at harvest respectively compared to other treatment combination. The plant height significantly increased by RDF along with soil application of Sulphur and foliar nutrition at active vegetation and flowering stage of the crop. This conjunctive application of soil and foliar application of balanced nutrients to the crop might have enjoyed with sufficient nutrient condition for a longer period of time and the nutrients uptake thereby allowing the plant to perpetuate with plant height [12].

Effect on leaf area index (LAI)

The highest LAI of 1.90, 2.72 and 4.38 at 30, 45 DAS and at harvest respectively were recorded in the treatment RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ (M₃). This was ascribed due to the Sulphur application leads to higher absorption and translocation of nutrients to shoot which has increased the leaf area index and number of leaves plant⁻¹ in black gram. This significant influence of Sulphur application on increasing the growth and yield might be attributed to its role in chlorophyll synthesis [13]. Among the sub-plot treatments, the highest LAI were observed in foliar spray of 3 per cent seaweed extract @ 30 and 45 DAS (S₄) of 1.88, 2.70 and 3.91 at 30, 45 DAS and at harvest, respectively. Foliar application of seaweed extracts was recommended in different types of plants as the nutrients are directly absorbed by the leaves when applied onto the shoots of plant [14].

Regarding the interactions, RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ coupled with foliar application of 3 per cent seaweed extract on 30 and 45 DAS (M₃S₄) recorded an increased performance of LAI. During flowering stage, application of RDF along with soil application of Sulphur and foliar nutrition had greatly influenced the LAI owing to more number of branches and leaves. This might be due to optimum supply of nutrients which increased the plant growth, leaf number, leaf length and breadth [15].

Effect on dry matter production (DMP)

All the treatments exerted significant influence over dry matter production of black gram. The highest DMP of

1265.64, 2536.69 and 3786.51 kg ha⁻¹ at 30, 45 DAS and at harvest respectively were recorded in the treatment RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ (M₃). The increase in dry matter accumulation under higher level S fertilization was probably due to adequate application of Sulphur which was directly involved in better absorption of applied nutrients and cell multiplication as well as expansion of deep green color leaves due to higher chlorophyll synthesis resulting into increase in photosynthetic rate in comparison with plants deficient in Sulphur [16]. Among the sub-plot treatments, the highest DMP were observed in foliar spray of 3 per cent seaweed extract @ 30 and 45 DAS (S₄) of 1157.36, 2311.06 and 3459.89 kg ha⁻¹ at 30, 45 DAS and at harvest, respectively (Table 1). The

appreciable increments in respect of plant height and leaf area index noticed in this treatment have positively reflected upon enhanced crop dry matter production [17].

Regarding the interactions, RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ along with foliar application of 3 per cent seaweed extract on 30 and 45 DAS (M₃S₄) recorded an increased performance of dry matter of black gram. The amount of dry matter produced is an indicator of overall effect of utilizing resource and better light interception. Higher LAI and increased availability of nutrients due to efficient soil and foliar nutrition in treatment (M₃S₄) might have impacted better assimilatory potential to the crop, which is evident from the increased dry matter of black gram [18].

Table 1 Effect of Sulphur application with organic foliar nutrition on plant height, leaf area index, dry matter production at 30, 45 DAS and at harvest stage of black gram

Treatments	Plant height (cm)			Leaf area index (LAI)			Dry matter production (Kg ha ⁻¹)		
	30 DAS	45 DAS	harvest	30 DAS	45 DAS	harvest	30 DAS	45 DAS	Harvest
Soil application									
M ₁	16.08	26.75	31.71	1.19	1.73	2.83	888.29	1766.73	2641.10
M ₂	21.04	32.09	36.67	1.73	2.46	3.67	1090.16	2173.70	3253.67
M ₃	26.00	37.01	41.92	1.90	2.72	4.38	1265.64	2536.69	3786.51
SEd	0.76	0.77	0.75	0.05	0.40	0.11	29.35	58.54	86.87
CD (p=0.05)	1.52	1.54	1.52	0.11	0.28	0.22	58.72	117.09	173.74
Foliar spray									
S ₁	20.03	30.92	35.75	1.36	1.97	3.48	1044.83	2079.55	3113.62
S ₂	22.05	32.95	37.78	1.70	2.41	3.79	1117.66	2235.75	3345.70
S ₃	19.06	29.91	34.74	1.49	2.15	3.31	991.88	2007.21	2982.92
S ₄	23.02	34.00	38.81	1.88	2.70	3.91	1157.36	2311.06	3459.89
S ₅	21.04	31.96	36.75	1.62	2.30	3.64	1081.75	2161.63	3233.35
SEd	0.30	0.40	0.44	0.02	0.20	0.04	14.33	28.08	42.41
CD(p=0.05)	0.63	0.82	0.91	0.06	0.43	0.10	29.57	57.96	84.83

M₁- RDF (25:50:0 NPK kg ha⁻¹) + no Sulphur application

M₂- RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 10 kg ha⁻¹,

M₃- RDF (25:50:0 NPK kg ha⁻¹) + soil application of Sulphur @ 20 kg ha⁻¹ and

S₁- Foliar application of 2 per cent DAP on 30 and 45 DAS,

S₂- Foliar application of 3 per cent Panchagavya on 30 and 45 DAS,

S₃- Foliar application of 3 per cent nitrobenzene on 30 and 45 DAS,

S₄- Foliar application of 3 per cent seaweed extract on 30 and 45 DAS

S₅- Foliar application of 2 per cent Vermi wash on 30 and 45 DAS

CONCLUSION

Based on the results of field experiment, it might be inferred that application of RDF (25:50:0 NPK kg ha⁻¹) + soil

application of sulphur @ 20 kg ha⁻¹ coupled with foliar spray of 3 per cent seaweed extract @ 30 and 45 DAS (M₃S₄) is an efficiently suitable nutrient management practices for enhancing the growth attributes in irrigated blackgram.

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