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Short Communication

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

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Sulphur is recognized as the fourth major plant nutrient after nitrogen, phosphorus and potassium in all the crops. But importance of Sulphur application has not so far fully relished by farmers. Sulphur influences plant growth in two ways, firstly by acting as a nutrient and secondly by improving the favorable soil conditions. Sulphur plays an important role not only in boost up the productivity but also improve the quality of the black gram. The scientific community all over the world is desperately looking for an economically viable socially safe and environmentally sustainable alternative to the agro-chemicals [1].

Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching and fixation and regulating the uptake of nutrient by plants [2]. Foliar feeding can be effective management tool to favourably influence pre-reproductive growth stages by compensating of environmentally induced stresses of adverse growing conditions or poor nutrient availability. Foliar application also could be used for different purposes including mitigating the negative damages of many stresses viz., heat, drought, frost and spraying different plant nutritional compounds viz., simple sugars, disaccharides, growth regulators and stimulators, amino acids, peptide chains, pesticides and nano materials [3]. Foliar application of 2 per cent DAP twice at flower initiation and pod formation stages of crop growth recorded better yield parameters, yield and economic returns in many crops [4]. Plant growth substances present in Panchagavya help to bring rapid changes in phenotypes of plants and also improves the growth and ultimately improves the productivity of the crops [5]. Nitrobenzene can be used as spray or in granular form, which increases flower forming substances by altering auxin, cytokinin, gibberellic acid and ethylene ratio, thereby increasing flowers by more than 40 to 45 per cent and yield. Seaweed liquid fertilizers are useful for achieving higher agricultural production, because the extract contains growth promoting hormones such as auxins, gibberellins, cytokinins, abscisic acid, ethylene and polyamines other than the trace elements, vitamins, amino acids, antibiotics and micronutrients [6]. Application of Vermi wash is potentially sustainable in agriculture with respect to its origin, cost effectiveness, availability, reproducibility, reliability as well as biopesticide and ecofriendly soil conditioner. The foliar spray of Vermi wash provides necessary nutrients to the growing plant for elongation, early flowering and fruiting phase. Therefore, keeping the above facts in view, the present investigation was undertaken to examine the effect of Sulphur application with organic foliar nutrition on yield attributes and yield of irrigated Black gram.

The field experimental was conducted to study the effect of Sulphur application with organic foliar nutrition on yield attributes and yield of irrigated black gram at Periyanarkunam village, Bhuvanagiri taluk, during March – May 2018. 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 (M_1), RDF (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 10 kg ha^{-1} (M_2), RDF (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3). The sub treatment comprised of foliar application of 2 per cent DAP (S_1), foliar application of 3 per cent Panchagavya (S_2), foliar application of 3 per cent nitrobenzene (S_3), foliar application of 3 per cent seaweed extract (S_4) and foliar application of 2 per cent Vermi wash (S_5) on 30 and 45 DAS respectively. The nitrogen content in the crop samples were estimated by Microkjeldhal method as suggested by Yoshida *et al.* [7]. The phosphorus content was estimated by using triple acid digestion method as described by Jackson [8] 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

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described by Jackson [8] using flame photometer. The potassium content of sample was calculated from the standard curve drawn and expressed in kg ha^{-1}.

Number of pods plant^{-1}

The observations recorded on the number of pods plant^{-1} were presented in (Table 1) revealed that application of recommended dose of fertilizers (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3) was superior over the other treatments. The treatment recorded the highest number of pods plant^{-1} of 24.09 (Fig 1). This was augmented that application of S increases the yield by increasing the S from source (assimilate) to sink (seed) which would have increased the number of pods plant^{-1}. Application of Sulphur could have improved the nitrate recovery and diversion of greater proportion of assimilation to developing pods [9]. This result was in close association with the findings of Shubhangi *et al*., (2014). Regarding the sub plot treatments, foliar application of 3 per cent seaweed extract on 30 and 45 DAS (S_4) recorded increased number of pods plant^{-1} of 20.83. Application of seaweed extract enhanced the number of pods plant^{-1} and pod weight [10]. This was in concurrence with the findings of Ganesh *et al*., (2015). 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 (M_3S_4) and recorded the highest value regarding number of pods plant^{-1} of black gram. Seaweed sap along with recommended dose of fertilizers (RDF) application significantly produced higher number of pods plant^{-1} [11].

Table 1 Effect of sulphur application with organic foliar nutrition on yield attributes and yield of irrigated blackgram

Treatments	Number of pods plant^{-1}	Number of grains pod^{-1}	Test weight (g)	Grain yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
			Soil application		
M_1	13.60	4.04	3.94	634.10	1444.72
M_2	18.73	5.48	3.95	920.67	1781.52
M_3	24.09	6.94	4.00	1223.40	2156.34
SEd	0.82	0.22	NS	48.64	54.56
CD (p=0.05)	1.65	0.45	NS	97.29	109.14
			Foliar spray		
S_1	17.76	5.23	3.99	861.27	1720.00
S_2	19.82	5.80	3.96	989.83	1860.06
S_3	16.78	4.83	3.95	791.80	1652.21
S_4	20.83	6.08	3.96	1066.15	1942.93
S_5	18.85	5.51	3.97	920.64	1795.78
SEd	0.28	0.08	NS	17.96	24.46
CD (p=0.05)	0.59	0.17	NS	37.08	48.95

Number of seeds pod^{-1}

Among the main plot treatments RDF (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3) recorded highest number of seeds pod^{-1} of 6.94. This might be due to synergism between S and most of nutrients which was responsible for higher growth, yield and also leads to encourage the nutrient availability and assimilation [12]. Among the sub plot treatments, foliar application of 3 per cent seaweed extract on 30 and 45 DAS (S_4) recorded increased number of seeds pod^{-1} (6.08) of black gram. Application of seaweed extracts were very effective in enhancing the growth, yield, pods, number of seeds pod^{-1}, seed weight plant^{-1}, and quality of seeds. 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 (M_3S_4) recorded an increased performance of number of seeds pod^{-1} of black gram [13].

Test weight / 100 grain weight

The result showed that hundred grain weight was not influenced by the treatments. Hence, hundred grain weight is mainly governed by the inherent genetic makeup of the cultivar, the treatment effect was not inflected over the character.

Grain yield

All the treatments exerted significant influence over grain yield of black gram. The data presented in (Table 1) revealed that among the main plot treatments RDF (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3) recorded highest grain yield of 1223.40 kg ha^{-1} (Fig 2). Improvement in the yield might have resulted from significant and progressive effect of Sulphur on yield attributes and efficient and greater partitioning of metabolites and adequate translocation of nutrient to developing structure [14]. Among the sub plot treatments, foliar application of 3 per cent seaweed extract on 30 and 45 DAS (S_4) recorded increased grain yield of 1066.15 kg ha^{-1}. The increase in grain yield was due to increase in number of branches plant^{-1} as well as number of pods plant^{-1}. The beneficial effects of seaweed extract may be due to higher level of beneficial compounds that useful for plant growth and development and ultimately increased the yield [15].

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 (M_3S_4) recorded an increased performance of grain yield of black gram. The treatment combination of seaweed extract along with RDF showed the maximum increase in yield. The increased yield might be due to the presence of growth promoting substances such as IAA, IBA, gibberellins, cytokinins, micronutrients, amino acids [16].

Haulm yield

Among the main plot treatments RDF (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3) recorded highest haulm yield of 2156.34 kg ha^{-1}. Application of Sulphur might have increased the availability of nutrients to plant due to improved nutritional environment, which in turn favourably influenced the energy transformation, activation of enzymes, chlorophyll synthesis as well as increased carbohydrate metabolism [9].

Regarding sub plot treatments, foliar application of 3 per cent seaweed extract on 30 and 45 DAS (S_4) recorded increased haulm yield of 1942.93 kg ha^{-1}. The haulm yield enhancement was due to the continuous supply of nutrients which in turn increased the leaf area and dry matter production resulting in higher haulm yield [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 (M_3S_4) recorded an increased performance of haulm yield of black gram. Results conclusively proved that treatments offering efficient nutrient management recorded increased the haulm yield of black gram. Haulm yield was also found significant resulted due to significant response of plant growth parameters viz. plant height, number of branches per plant [18].

SUMMARY

Field investigation was carried out to study the effect of Sulphur application with organic foliar nutrition on yield attributes and yield of irrigated black gram at Periyanarkunam village, Bhuvanagiri taluk, during March – May 2018. All the treatments significantly influenced the yield attributes and yield of black gram. The result of the main field showed that recommended dose of fertilizers (RDF) (25:50:0 NPK kg ha^{-1}) + soil application of Sulphur @ 20 kg ha^{-1} (M_3) in main plot registered significantly improved yield attributes viz., number of pods $plant^{-1}$ (24.09), number of grains pod^{-1} (6.94) and yield viz., grain yield (1223.4 kg ha^{-1}) and haulm yield (2156.34 kg ha^{-1}). Among the foliar nutrition in the sub plot, application of three per cent seaweed extract (S_4) significantly increased yield attributes viz., number of pods $plant^{-1}$ (20.83), number of grains pod^{-1} (6.08), grain yield (1066.15 kg ha^{-1}) and haulm yield (1942.93 kg ha^{-1}). 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 days after sowing (M_3S_4) excelled all other treatments by recording highest yield attributes and yield of irrigated black gram. 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% seaweed extract @ 30 and 45 DAS (M_3S_4) recommended to augmenting the productivity and profit of black gram.

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