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Effect of growth regulator, organic and inorganic foliar nutrition on the growth and yield of blackgram *(Vigna mungo L.)*under rainfed condition*

Blackgram (*Vigna mungo* L.) is one of the major rainy season pulse crops also known as urd or mash grown throughout India. It is consumed in the form of "dal". In India, blackgram is grown on 2.70 million hectare area with a production of 0.94 million tonnes. In Karnataka, it is grown on an area of 1.26 lakh hectares with a production of 0.64 lakh tonnes (Anon., 2011). The yield potential of blackgram is very low because of the fact that the crop is mainly grown in rainfed conditions with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crop. Apart from the genetic makeup, the physiological factor *viz.,* insufficient portioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stages of crop growth, coupled with a number of diseases and pests (Mahala *et al.,* 2001) were the reasons for the poor yield.

The productivity of pulse crops in our country, including blackgram is not sufficient enough to meet the domestic demand of the population. Hence, there is need for enhancement of the productivity of blackgram by proper agronomic practices.

Several strategies have been initiated to boost the productivity of blackgram. One among them is foliar application of organic and inorganic sources of nutrients for exploiting genetic potential of the crop. This is considered to be an efficient and economic method of supplementing part of the nutrient requirements at critical stages. Nutrients play a pivotal role in increasing the seed yield in pulses (Chandrasekhar and Bangarusamy, 2003). 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 (Manonmani and Srimathi, 2009). Foliar application of nutrients using water soluble fertilizer is one of the possible ways to enhance the productivity of pulses like greengram and blackgram.

A field experiment was conducted during *kharif* season of 2011 at Agricultural Research Station, Annigeri, Dharwad district (Zone-03), University of Agricultural Sciences, Dharwad to study the effect of growth regulator, organic and inorganic foliar nutrient sprays. The soil of the experimental site was medium black clay with pH 7.90, organic carbon 0.51(%), available N 212.40, P_2O_5 22.90 and K_2O 270 kg /ha. The treatments comprised of T_1: RDF + foliar spray of 3% panchagavya, T_2: RDF + foliar spray of 5% cow urine, T_3: RDF + foliar spray of 2% Di- ammonium phosphate (DAP), T_4: RDF + foliar spray of 2% urea, T_5: RDF + foliar spray of 0.5% chelated micronutrient, T_6: RDF + foliar spray of 40ppm Naphthalene Acetic Acid (NAA), T_7: RDF + foliar spray of 1% salicylic acid, T_8: RDF + foliar spray of 2% DAP + 0.5% chelated micronutrient, T_9: RDF + foliar spray of 40 ppm NAA + 0.5% chelated micronutrient + 2% DAP, T_{10}: RDF + foliar spray of 1% salicylic acid + 2% DAP, T_{11}: control (RDF+ no spray), T_{12}: farmer's practice (50 kg DAP ha^{-1}). The experiment was laid out in a randomized complete block design with three replications. Farmyard manure @ 6 t ha^{-1} was incorporated through broadcasting three weeks before sowing in all the except T_{12} treatments, in the later it was 3 t/ha^{-1}. The inorganic fertilizers were applied to all plots at the rate of 12 kg N and 25 kg P_2O_5/ha in the form of urea and Di- ammonium phosphate, respectively (for farmers practice only FYM applied @ 3 t/ha and 50 kg DAP ha^{-1}). Two foliar nutrient sprays were applied at 35 and 50 days after sowing coinciding with flowering and

Table 1. Growth and growth components of blackgram as influenced by foliar application of growth regulator, organic and inorganic nutrients

Treatment	Plant height at harvest (cm)	Number of branches $plant^{-1}$ at harvest	Dry matter production at harvest (g $plant^{-1}$)	LAI at 60 DAS	LAD at 41-60 DAS
T_1: RDF + foliar spray of 3% Panchagavya	26.15	6.53	11.74	2.86	42.31
T_2: RDF + foliar spray of 5% Cow urine	25.05	6.20	10.96	2.61	39.52
T_3 : RDF + foliar spray of 2% DAP	31.95	7.33	13.11	3.34	50.63
T_4 : RDF + foliar spray of 2% Urea	29.91	6.93	12.67	3.19	47.05
T_5: RDF + foliar spray of 0.5% chelated micronutrient (Zn, Fe, B and Mo)	27.13	6.60	11.92	2.98	43.82
T_6 : RDF + foliar spray of 40 ppm NAA	28.21	6.73	12.26	3.05	45.08
T_7 : RDF + foliar spray of 1% salicylic acid	23.73	5.93	10.53	2.56	38.75
T_8 : RDF + foliar spray of 2% DAP + 0.5% chelated micronutrient	33.31	7.80	14.03	3.63	54.10
T_9 : RDF + foliar spray of 40 ppm NAA+ 0.5% chelated micronutrient + 2% DAP	37.11	8.27	15.98	4.18	60.45
T_{10}: RDF + foliar spray of 1% salicylic acid + 2% DAP	16.07	3.93	6.20	2.06	28.80
T_{11}: Control (RDF + No spray)	21.53	5.00	9.36	2.36	34.77
T_{12}: Farmer's practice (50 kg DAP ha^{-1})	19.68	4.27	8.45	2.27	32.37
S. Em.±	1.32	0.56	0.69	0.23	2.54
C.D. (P=0.05)	3.87	1.64	2.01	0.66	7.45

DAS- Days after sowing, RDF - Recommended dose of fertilizer (12.5:25:0 NPK kg ha^{-1}),

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pod filling stages for all the treatments except T_{11} and T_{12}. Variety TAU-1 was sown in 30 cm x 10 cm spacing on 7th June, 2011 and harvested on 2nd September, 2011.

Significantly higher growth components such as plant height (37.11 cm), number of branches (8.27 plant^{-1}), leaf area index (4.18), leaf area duration (60.45) and total dry matter production (15.98 g plant^{-1}) were recorded in T_9 (RDF + foliar spray of 40ppm NAA + 0.5% chelated micronutrient + 2% DAP) over rest of the treatments. However, it was at par with T_8 (Table 1). Increase in growth with the basal application of RDF as a basal dose and application of foliar nutrition might be due to the fact that foliar application of NAA promoting the apical dominance, cell elongation and shoot development. Foliar application of chelated micronutrient enhances the synthesis of carbohydrates and protein. In addition foliar application of DAP at critical stages of the crop enhanced better photosynthetic activity as reported by Subramani *et al.* (2002), Chandrasekhar and Bangarusamy (2003), Dixit and Elamathi (2007) and Ganapathy *et al.* (2008).

Application of RDF + foliar spray of 40ppm NAA + 0.5% chelated micronutrient + 2% DAP (T_9) recorded significantly higher grain yield (1298 kg ha^{-1}) and number of pods/plant (38.73), but it was at par with T_8. Such of the results were also authenticated by Subramani *et al.* (2002), Chandrasekhar and Bangarusamy (2003), Dixit and Elamathi (2007), Mondal *et al.* (2011) and Gnapathy *et al.* (2008).

Significantly higher net returns (₹ 35,431 ha^{-1}) and B:C ratio (3.03) were noticed in T_9 over rest of the treatments, but it was at par with T_8 (Table 3). The higher gross returns, net returns and B:C ratio obtained under these treatments were due to higher productivity in terms of yield. Such results were supported by Yakadri and Thatikunta (2002), Chandrasekhar and Bangarusamy (2003), and Dixit and Elamathi (2007).

Application of RDF + foliar spray of 40 ppm NAA+ 0.5% chelated micronutrient + 2% DAP (T_9) significantly increased the grain yield and net returns compared to farmer's practice and control.

Table 2. Grain yield and yield components of blackgram as influenced by foliar application of growth regulator, organic and inorganic nutrients

Treatment	Grain yield (kg ha^{-1})	Number of pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Test weight (1000 seed wt.) (g)
T_1: RDF + foliar spray of 3% Panchagavya	905	26.53	5.07	5.93	55.67
T_2: RDF + foliar spray of 5% Cow urine	836	24.47	4.86	5.47	49.30
T_3 : RDF + foliar spray of 2% DAP	1179	31.33	5.67	6.33	59.07
T_4 : RDF + foliar spray of 2% Urea	1143	29.27	5.43	6.27	57.50
T_5: RDF + foliar spray of 0.5% chelated micronutrient (Zn, Fe, B and Mo)	973	27.20	5.20	6.00	55.50
T_6 : RDF + foliar spray of 40 ppm NAA	1067	27.93	5.31	6.27	56.83
T_7 : RDF + foliar spray of 1% salicylic acid	772	22.60	4.70	5.40	47.17
T_8 : RDF + foliar spray of 2% DAP + 0.5% chelated micronutrient	1237	34.13	5.88	6.33	60.67
T_9 : RDF + foliar spray of 40 ppm NAA+ 0.5% chelated micronutrient + 2% DAP	1298	38.73	6.03	6.47	61.90
T_{10}: RDF + foliar spray of 1% salicylic acid + 2% DAP	566	15.09	3.57	4.27	42.17
T_{11}: Control (RDF + No spray)	749	21.80	4.29	4.93	45.67
T_{12}: Farmer's practice (50 kg DAP ha^{-1})	662	18.40	3.98	4.47	44.00
S. Em.±	39.8	1.40	0.12	0.29	1.15
C.D. (P=0.05)	116.8	4.11	0.36	0.85	3.36

DAS- Days after sowing, RDF - Recommended dose of fertilizer (12.5:25:0 NPK kg ha^{-1}),

Table 3. Economics of blackgram as influenced by foliar application of growth regulator, organic and inorganic nutrients

Treatment	Net returns (₹ ha^{-1})	B:C ratio
T_1: RDF + foliar spray of 3% Panchagavya	19,974	2.17
T_2: RDF + foliar spray of 5% Cow urine	17,367	2.03
T_3 : RDF + foliar spray of 2% DAP	31,156	2.84
T_4 : RDF + foliar spray of 2% Urea	29,843	2.78
T_5: RDF + foliar spray of 0.5% chelated micronutrient (Zn, Fe, B and Mo)	22,756	2.33
T_6 : RDF + foliar spray of 40 ppm NAA	26,697	2.58
T_7 : RDF + foliar spray of 1% salicylic acid	10,448	1.49
T_8 : RDF + foliar spray of 2% DAP + 0.5% chelated micronutrient	33,148	2.92
T_9 : RDF + foliar spray of 40 ppm NAA+ 0.5% chelated micronutrient + 2% DAP	35,431	3.03
T_{10}: RDF + foliar spray of 1% salicylic acid + 2% DAP	1,880	1.09
T_{11}: Control (RDF + No spray)	14022	1.84
T_{12}: Farmer's practice (50 kg DAP ha^{-1})	12,180	1.81
S. Em.±	940	0.05
C.D. (P=0.05)	2925	0.17

DAS- Days after sowing, RDF - Recommended dose of fertilizer (12.5:25:0 NPK kg ha^{-1}),

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