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RESEARCH ARTICLE

Management of source limitation by foliar spray of nutrients and growth regulators in blackgram

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SUMMARY

Foliar spray of nutrient mixture combined with salicylic acid (100 ppm) at 20, 30 and 40 DAS proved to be the best treatment in showing the significant results in leaf area index, leaf area duration, specific leaf weight, total dry matter accumulation and seed yield. Foliar spray of nutrient mixture with salicylic acid was helpful in increasing LAI to 3.51 from 2.13 and the per cent increase over control is 37. The LAD is extended to five days and per cent increase over control is 16. By increasing the source size by the nutrient mixture with salicylic acid, the yield is raised to 26 per cent over control.

Key Words **:** Growth regulators, Blackgram, Foliar spray, Dry matter accumulation Micro nutrients

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Urdbean [*Vigna mungo* (L.) Hepper] is an important pulse crop grown throughout India. It is grown in an area of about three million hectares in India. It is mainly used as 'dal' and in preparation of many dishes in our diet. It is very rich in protein, containing about 25 per cent protein in its seeds and is the richest source of phosphoric acid among the pulses. Beside, green fodder of urdbean is very nutritive and is especially useful for milch cattle. It can also be used as green manure. It also acts as a cover crop and its deep root system protects the soil from erosion. It has the capacity to fix atmospheric nitrogen and thus restoring the soil fertility. The yield of black gram is comparatively lower than the other grain legumes. Over past three decades there has been a dramatic improvement in the yield of cereal grains. This was achieved by manipulation of the genetic make up and physiological characteristics of these crops. The lower yield of black gram is due to shorter growth duration, particularly the slow rate of dry matter accumulation prior to flowering, unfavourable canopy structure, abscission of reproductive organs etc.

It was observed that black gram developed less than 50 per cent of canopy prior to flowering (Biawas and Mandal, 1988). Total dry matter produced prior to flowering was around 20 per cent of total dry matter attained at maturity. Maximum CGR synchronized with the attainment of maximum leaf mass immediately after flowering which was also for a brief period. Dry matter accumulation after flowering greatly influences seed yield, for most of the photosynthates produced at this stage is used for pod and seed development. Balanced nutrition ensures high yield and quality. Often, a starter dose of nitrogen and adequate phosphors dressing is essential to achieve the desired yield. In the past, several workers have reported increase in growth and yield parameters with use of micro nutrients and growth regulators. So keeping in the view of above points, proposed study was undertaken on blackgram with the objective, to find out the most effective and optimum concentration of micro nutrients and plant growth regulators to increase the source size thereby improvement in yield.

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MATERIALS AND METHODS

The experiment was conducted at Agricultural College and Research Institute, Madurai during the year 2010-2011. Spraying of micro nutrient mixture and growth regulators was done at 20, 30 and 40 DAS in the black gram culture KBG ACM 05 001 with three replications in Randomized Block Design with the following treatments.

T_1- Nutrient mixture (DAP-1%, potash – 1%, $ZnSO_4$ - 0.1%, boric acid - 0.1%, $MnSO_4$ - 0.1%, $MgSO_4$ – 0.1%, $FeSO_4$ – 0.1%, $CuSO_4$ – 0.1%, ammonium molybdate – 0.025 %, cobalt nitrate-0.025%), T_2 - NAA (40ppm), T_3 - Salicylic acid (100ppm), T_4 - brassinolide (0.1ppm), T_5 - T_1+T_2, T_6 - T_1+T_3, T_7 - T_1+T_4, T_8 - T_2+T_3+T_4, T_9 - T_1+ T_2+T_3+T_4 and T_{10} - water spray.

Observations recorded on leaf area index, leaf area duration, specific leaf weight at ten days after spraying and TDMA ,100 seed weight and seed yield were recorded at the time of harvest.

RESULTS AND DISCUSSION

Leaf area index determines the total photosynthesizing area available to the plant and the quantum of metabolites that would be ultimately available for translocation to the sinks. The observed data revealed that foliar spray of nutrient mixture significantly enhanced LAI. Foliar spray of nutrient mixture combined with salicylic acid (100 ppm) at 20, 30 and 40 DAS proved to be the best treatment in showing the significant results in leaf area index (3.51) and this treatment was helpful in increasing LAI to 3.51 from 2.13 and the per cent increase over control is 37. This accumulated more photosynthesis, which increased the LAI.

The values of leaf area duration (LAD) provide the information on source activity. Longevity of active leaf favours for sustained photosynthetic activity and improved seed filling. The LAD at 70DAS was extended to five days in foliar spray of micro nutrients and salicylic acid and per cent increase over control was 16.

Specific leaf weight (SLW) is the leaf dry weight per unit leaf area and is a useful growth character, which can be used as a selection criterion while evaluating the yield potential of crop plants. The SLW is considered as a positive reliable index for improving seed yield of crops and it indicates the quantity of metabolites (photosynthates) accumulated per unit leaf area. Foliar spray of nutrient mixture and salicylic acid at different stage of plant growth improved the specific leaf weight and this was due to accumulation of photosynthates within specific leaf area. The high SLW might lead to more translocation of metabolites to the developing sink to meet its demand, and hence, the increase in seed yield occured. The results of Kanakadurga *et al*. (2003) in cultivars of both greengram and blackgram supported the trend of results obtained in this case.

Application of growth regulating chemicals were effective in increasing the seed weight, particularly foliar spray of growth hormones enhanced the seed weight (5.97) by ten per cent over control (5.41). Venkatesan (2004) has made similar reports in maize. Nutrient and growth regulating chemical enchanced water and nutrient uptake, which in turn, increased the partitioning percentage and translocation especially to reproductive parts which in turn, increased the 1000 grain weight in cereals (Sairam, 1994). Rajkumar *et al.* (1996) also expressed the same results. Asgarjalis (1986) reported that wheat seeds treated with 0.5 per cent $CaCl_2$ registered the highest grain yield due to higher 100 grain weight and number of grains per ear.

The first prerequisite for higher yields is an increase in the total dry matter production (TDMP) per unit area. The data presented in Table 3 clearly indicate that the foliar spray

Table 1: Effect of micro nutrients and growth regulators on LAI and LAD

	Leaf area index					Leaf area duration (days)			
Treatments	30 DAS	40 DAS	50 DAS	60DAS	Harvest	30 - 40	40-50	50-60	60-70
T_1	0.98	0.95	1.52	2.88	2.00	10.1	12.3	13.6	18.21
T_2	0.93	0.95	1.32	2.10	1.97	9.7	11.5	12.1	15.30
T_3	0.94	0.94	1.40	2.58	2.54	10.0	11.3	12.5	18.40
T_4	0.93	0.98	1.42	2.53	1.88	9.8	11.8	12.6	15.60
T_5	0.89	0.92	1.45	2.23	2.10	10.5	12.4	13.8	15.90
T_6	0.93	0.91	1.32	3.51	2.14	10.2	12.6	13.7	18.86
T_7	0.92	0.95	1.33	2.81	1.98	10.1	12.7	13.8	15.70
T_8	0.91	0.98	1.15	2.23	2.17	9.9	10.9	12.2	17.60
T_9	0.98	0.99	1.92	2.73	2.14	10.3	12.2	13.5	17.51
T_{10}	0.87	0.93	1.25	2.13	1.47	10.0	10.9	12.3	14.80
S.E.±	0.033	0.017	0.111	0.189	0.113	0.170	0.382	0.494	0.221
C.D. (P=0.05)	0.069	0.057	0.234	0.397	0.224	0.357	.803	1.038	0.465

Table 2: Effect of micro nutrients and growth regulators on SLW

	Specific leaf weight (mg cm^{-2})				
Treatments	30 DAS	40 DAS	50 DAS	60 DAS	Harvest
T_1	4.80	5.52	5.91	6.30	5.98
T_2	4.21	5.30	5.73	6.11	5.48
T_3	4.11	5.28	5.82	6.92	6.15
T_4	4.22	5.31	5.91	5.93	5.11
T_5	4.81	5.42	5.92	6.32	5.97
T_6	4.51	5.52	5.93	6.99	6.99
T_7	4.32	5.58	6.22	6.72	6.12
T_8	4.18	5.10	5.81	6.20	5.97
T_9	4.75	5.48	5.90	6.81	6.47
T_{10}	4.30	5.51	5.85	5.32	4.91
SEd.	0.170	.382	0.494	0.805	0.748
CD (0.05)	0.357	0.803	1.038	1.680	1.472

Table 3: Effect of micro nutrients and growth regulators on yield parameters

Treatments	TDMA(g)	100 seed weight (g)	Seed yield kg ha^{-1}	B:C ratio
T_1	16.28	5.14	934	1.53
T_2	14.21	5.56	841	1.32
T_3	16.13	5.38	948	1.67
T_4	15.71	5.13	889	1.46
T_5	16.32	5.22	922	1.22
T_6	17.98	5.21	1011	1.96
T_7	15.93	5.64	971	1.56
T_8	16.85	5.32	878	1.32
T_9	17.98	5.97	984	1.48
T_{10}	15.93	5.41	742	1.14
SEd	0.297	0.36	97	
CD(0.05)	0.483	0.69	193	

of nutrient mixture combined with salicylic acid (100 ppm) at 20, 30 and 40 DAS proved to be the best treatment in showing the significant results in total dry matter accumulation (17.98g). Nutrient and salicylic acid sprayed plants had higher TDMP followed by NAA, salicylic acid and brassinoloide. Plant nutrients with salicylic acid improved the biomass accumulation by enhancing the leaf water potential and this might have led to higher CO_2 exchange rate and hence the positive effect.

Spraying of plant growth regulating chemicals showed profound influence on seed yield (1011 kg ha^{-1}). This may be attributed to the fact that the increased growth character of LAI, LAD, specific leaf weight and beneficial role of macro and micro nutrients on enhancing the assimilation, photosynthetic activities and translocation efficiency to developing sink. By increasing the source size by the nutrient mixture with salicylic acid, the yield is raised to 26 per cent over control. This is in accordance with the findings of

Jeyakumar *et al*. (2008) in greengram and Nagasubramaniam *et al*. (2007) in baby corn.

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