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Impact of Growth Regulating Substances in Improving Crop Establishment and Harvest Index in Blackgram and Greengram under Sodicity

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Field study was conductedunder sodic soil conditions with two crop varieties of greengram VBN (Gg) 2 andblackgram VBN (Bg) 6 with ten treatment combinations were employed by seed treated with cowpea sprout extract (2%), GA_3 50 ppm and ammonium molybdate 0.05 % followed by foliar spray with $ZnSO_4$ (0.5%), panchagavya(1%) and KCl(1%) along with control to improve the establishment under sodicity stress. The foliar spray was imposed on 30th and 45th day after sowing. Among the treatment combinations, seed treatment with cowpea sprout extract (2%)+ foliar spray of panchagavya (1%) treatment recorded higher grain yield (785.3 Kg/ha) and harvest Index (29.6%) under sodicity compared with control. In blackgram also same treatmentrecorded higher grain yield and harvest index but the crop establishment and yield was lesser than greengram. From this study, it was concluded that,seed treatment with cowpea sprout extract (2%) + foliar spray of panchagavya (1%) was more effective to increase theseedling establishment, physiological traits and yield under sodic soil.

Key words: SPAD, Salt stress,Cowpea sprout extract, Harvest index.

Most of the pulses in India are grown in low fertility, problematic soils and unpredictable environmental conditions. Salinity is a major stress limiting the increase in the demand for food crops. More than 20% of cultivated land worldwide (about 45 hectares) is affected by salt stress and the amount is increasing day by day. Plants on the basis of adaptive evolution can be classified roughly into two major types: the halophytes (that can withstand salinity) and the glycophytes (that cannot withstand salinity and eventually die).Majority of major crop species belong to this second category. Thus salinity is one of the most brutal environmental stresses that hamper crop productivity worldwide(Munns and Tester, 2008).A major challenge towards world agriculture involves production of 70% more food crop for an additional 2.3 billion people by 2050 worldwide (FAO,2009).

The disturbing features in pulse production are poor establishment and low harvest index. In pulses harvest index is only 15-20% compared to 45-50% of cereals such as wheat and rice. Low harvest index results from excessive vegetative growth, but can be overcome by early partitioning of dry matter into seeds. The partitioning efficiency can be improved by physiological manipulations such as spraying of hormones and nutrients that reduce flower drop and thereby facilitate large sink size. Exogenous applications of growth regulators to alleviate salinity stress can be an economic and safe alternative to environment, which delay leaf senescence (cytokinins), prevent the abortion of fruits (auxins and gibberellins) and increase the leaf area (gibberellins).Growth regulators can improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source and sink in the field crops. Jayanthi et al.(2013) reported that seed fortification with 2% horsegram extract was found to boost the chlorophyll content of the plant to highest level at both vegetative and maturity stage in rice. Panchagavya is used as a foliar application to boost yield of crop plants and to restrict the incidence of common disease (Sangeetha and Thevanathan, 2010). Nasser Akbari et al.(2010) also reported that gibberellic acid (100 mg/L as seed pre-soaking and 100 mg/L as foliar application) overcome the effect of salt stress and improve the growth parameters in mung bean. In view of the above, the present investigation has been proposed to study the effect of plant growth regulators and nutrient and their stages of application on growth and yield in pulses.

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Material and Methods

Field experiment was carried out at Anbil Dharmalingam Agricultural College and Research Institute, Trichyduring late July to October 2014 under sodic soil condition. The nature of soil is sodicity with ESP of 18.94 % with pH of 8.82. The twovarieties of greengram VBN (Gg) 2 andblackgramVBN (Bg) 6 were employed in this study under sodic soil condition.Ten treatments with combinations such as T_1 : Control, T_2 : SeedTreatment (ST) with Ammonium Molybdate 0.05% + foliar spray of $ZnSO_4$ – 0.5%, T_3 : ST with Ammonium Molybdate 0.05% + foliar spray of panchagavya -1.0 %, T_4 :ST with Ammonium Molybdate 0.05% + foliar spray of KCl -1%, T_5 : ST with GA_3 50 ppm + foliar spray of $ZnSO_4$ – 0.5%, T_6

: ST with GA_3 50 ppm + foliar spray of panchagavya -1.0%,T_7: ST with $GA_3$50 ppm + foliar spray of KCl -1%,T_8: ST with Cowpea Sprout Extract 2% + foliar spray of ZnSO4 – 0.5%,T_9: ST with Cowpea Sprout Extract 2% + foliar spray of panchagavya -1.0%, T_{10}: ST with Cowpea Sprout Extract 2% + foliar spray of KCl -1 %. The experiment was laid out in a Randamized Block Design with three replications. Foliar spray was given at flower initiation and pod initiation stages. First observation was taken on 30th DAS and subsequent observations were taken at 15 days interval up to harvest.SPAD reading were recorded by using Chlorophyll meter (SPAD 502). The data were recorded as described by Peng *et al*. (1993).

Results and Discussion

Chlorophyll Meter reading

Chlorophyll meter reading is an important index to assess photosynthesis efficiency under salt tolerance and significant variations in chlorophyll value were observed in both pulses due to seed treatment and foliar spray

The results of Chlorophyll value exhibited an increasing trend up to pod formation stage with a drastic reduction at maturity in both pulses. In greengram,seed treatment with cowpea sprout extract 2% + foliar spray of panchagavya 1%recorded higher SPAD value of (55.6) at pod formation stage compared to blackgram variety recorded (35.1).A strong positive correlation was found between SPAD readings and nitrogen content of the leaves of sunflower (Montemurro and Giorgio, 2005). A strong positive correlation found between SPAD readings and extracted chlorophyll content was also established by Dwyer *et al*. (1991). These two correlation studies strongly support the results of the present study.

Yield components in green gram

The data on yield components such as number of pods per plant, number of seeds per plant, 100 seed weight, Grain yield, Biological yield, Harvest Index and lower Na/K ratio were recorded at the time of harvest in gsreengram varietyVBN

Table 1. Effect of growth regulating substances on SPAD value of greengram and blackgram varieties under sodicity

Treatments	Blackgram (VBN(Gg)2)			Greengram (VBN(Bg)6)		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T_1	19.2	36.0	24.4	17.2	20.1	18.3
T_2	19.8	38.5	27.8	18.3	22.2	19.6
T_3	20.9	40.5	28.8	19.5	23.4	19.9
T_4	19.9	40.3	28.8	19.2	23.8	20.1
T_5	27.9	45.4	29.7	20.1	24.2	20.4
T_6	31.9	51.2	34.0	23.2	31.0	26.3
T_7	31.1	47.8	33.9	22.1	28.4	22.5
T_8	30.3	47.4	33.0	20.3	26.3	24.1
T_9	33.3	55.6	35.5	28.4	35.1	30.1
T_{10}	32.1	50.1	35.0	26.5	32.8	28.2
Mean	26.64	46.88	31.1	21.48	26.73	22.95
SED	1.11	1.92	1.26	0.88	1.09	0.94
CD (0.05%)	2.33	4.02	2.65	1.84	2.30	1.97

(Gg)2. In thepresent study, seed treatment with cowpea sprout extract 2% + foliar spray of panchagavya 1 %recorded higher No of podsplant^{-1} (18.30), No of seedspod^{-1} (8.96), 100 seed weight (2.87),biological yield (2624.3kg/ha),grain yield (785.3 kg/ha) and Harvest Index (29.64).All the treatments differed significantly in Na/K ratio at maturity stages (Table 2). The best performing treatment maintain lowest Na/K ratio. Among the treatments, seed treatment with cowpea sprout extract 2% + foliar spray of panchagavya 1%registered the lowest Na/K ratio of 0.621 at maturity stage and shows higher tolerance

Yield components in blackgram

In blackgram variety, seed treatment with cowpea sprout extract 2% + foliar spray of panchagavya 1%recorded higher number of pods/plant (12.24), number of seeds/pod (7.85), 100 seed weight (2.6), biological yield (2482 kg/ha), grain yield (695 kg/ha) and Harvest Index (29.2)under sodicity with control.All the treatments differed significantly in Na/K ratio at maturity stages (Table 3). The best performing treatment maintain lowest Na/K ratio. Among the treatments, seed treatment with cowpea sprout extract 2% + foliar spray of panchagavya 1 %registered the lowest Na/K ratio of 0.725 at maturity stage and shows higher tolerance. Jayanthi *et al.*(2013)supported this finding with a view that treatments with 2% horsegram sprout extract recorded the highest yield of 3951 kg ha^{-1} in rice. The yield enhancement may be due to the presence of bioactive substances in sprouted

horse gram and cowpea extracts were found effective towards yield maximization in rice seeds. Gopal Lal Choudhary *et al*.(2017) reported that application of panchagavya 4% recorded significantly maximum dry matter and seed yield of 751 kg ha^{-1} in black gram. From this above study it was find out

Table 2.Influence of growth regulating substances on yield and yield contributing characters and Na/K ratio in greengram at maturity

Treatments	No of pods/ plant	No of seeds / pod	100 seed weight (g)	Grain yield kg/ha	Biological yield (kg/ha)	Harvest index (%)	Na/K ratio
T_1	12.24	7.14	2.58	601.2	2196.4	27.37	0.825
T_2	13.32	7.22	2.60	612.3	2226.4	27.50	0.802
T_3	15.12	7.32	2.64	636.1	2284.0	27.85	0.761
T_4	14.31	7.20	2.62	629.2	2254.7	27.91	0.777
T_5	16.14	7.33	2.65	674.5	2382.5	28.31	0.753
T_6	17.42	7.93	2.70	696.2	2434.2	28.60	0.722
T_7	17.33	7.51	2.69	683.7	2404.2	28.44	0.728
T_8	16.80	7.42	2.68	711.1	2503.2	28.41	0.735
T_9	18.30	8.96	2.87	785.3	2624.3	31.45	0.621
T_{10}	17.63	8.51	2.76	754.8	2546.6	29.64	0.698
Mean	15.9	7.7	2.7	682.5	2385.7	28.50	0.7
SED	0.65	0.32	0.11	27.79	97.53	1.17	0.031
CD (0.05)	1.36	0.66	NS	58.4	204.9	2.49	0.065

that seed treatment with cowpea sprout extract (2%) + foliar spray of panchagavya (1%) was more effective to increase seedling establishment, physiological traits and yield of green gram variety under sodicity .

Table 3.Influence of growth regulating substances on yield and yield contributing characters and Na/K ratio in blackgram at maturity

Treatments	No of pods/ plant	No of seeds / pod	100 seed weight	Grain yield kg/ha	Biological yield (kg/ha)	Harvest index (%)	Na/K ratio
T_1	6.54	5.21	2.0	519.21	2028.5	19.98	1.285
T_2	7.11	5.24	2.1	524.20	2111.4	20.09	1.254
T_3	7.24	6.11	2.2	556.10	2201.6	20.72	0.942
T_4	8.82	5.85	2.1	553.21	2199.4	20.61	1.223
T_5	7.33	6.01	2.2	566.22	2213.2	21.07	0.858
T_6	11.25	7.11	2.5	651.30	2298.2	27.47	0.828
T_7	10.78	6.45	2.3	635.44	2254.6	22.42	0.795
T_8	9.25	6.23	2.3	598.14	2216.3	22.48	0.852
T_9	12.24	7.85	2.6	695.10	2482.3	29.23	0.725
T_{10}	11.82	7.52	2.5	685.30	2345.3	27.94	0.768
Mean	9.24	6.36	2.28	523.32	2235.1	23.25	1.0
SED	0.38	0.26	0.10	21.56	91.2	0.96	0.040
CD (0.05)	0.80	0.55	NS	45.30	191.6	2.01	0.082

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