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A study on crop establishment and harvest indices of green gram and black gram under sodicity stress using organic methods

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Abstract
The disturbing features in pulse production are poor establishment and low harvest index. 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. To achieve these objectives, a laboratory screening and field study were carried out. Field experiment was conducted under sodic soil condition. six treatment combinations were employed by initial seed treated with Cowpea sprout extract (2%), GA_3 50 ppm and Ammonium Molybdate 0.05 % followed by foliar spray with Panchagavya(1%) and Kcl(1%) along with control. From this study it was concluded that Seed treatment with Cowpea sprout extract (2%) + foliar spray of Panchagavya -1.0 % was more effective to increase seed and seedling establishment and yield under sodic soil.

Keywords: Cow pea sprout extract, Panchagavya, Green gram, Black gram and harvest index.

Introduction
India is the largest producer and consumer of pulses in the world. However, pulses production has been stagnant between 11 and 14 million tonnes over the last two decades. Per capita pulses consumption over the years has come down from 61gm/day in 1951 to 30 gm/day in 2008. However, 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 (Ghafoor *et al*, 1993) [1]. Low HI results from excessive vegetative growth, but can be overcome by early partitioning of dry matter into seeds. Pulses in general have a high rate of flower drop. By decreasing flower drop, an enhanced sink could be provided; thereby yield can be increased considerably. Besides physiological manipulations, such as spraying of hormones and nutrients reduce flower drop and thereby facilitate larger sink size.

Most of the pulses in India are grown in low fertility, problematic soils and unpredictable environmental conditions. More than 87% of the area under pulses is rainfed. In these areas, issue is of availability of water. Thus, areas of pulse production in India are subject to drought and heat stress of arid and semi arid regions, which brings down its yield. Further, the arid and semi arid areas of the country face problem of alkaline and acidic soils. 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 [2] reported that seed fortification with 2% horse gram 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) [6]. Nasser Akbari *et al*, 2010 [3] 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.

Materials and Methods
The study was undertaken to find out the effect of sodicity on crop establishment and harvest index in green gram and black gram. A field experiment was carried out with two crops like green gram VBN (Gg) 2 variety & Black gram VBN (Bg) 5 variety were employed in this

study was conducted under sodic soil of Anbil Dharmalingam Agricultural College and Research Institute, Trichy. Field experiment was conducted during last Jan 2016 under sodic soil condition with six treatments of T_1 : Control**,** T_2 : ST with Ammonium Molybdate 0.05 % + foliar spray of Panchagavya -1.0 %, T_3 : ST with GA_3 50 ppm + foliar spray of Panchagavya -1.0 %, T_4 : ST with GA_3 50 ppm + foliar spray of KCl -1 %, T_5 : ST with Cowpea Sprout Extract 2% + foliar spray of Panchagavya -1.0 %, T_6 : ST with Cowpea Sprout Extract 2% + foliar spray of KCl -1 %. The chemical properties of this sodic soil were analyzed before the start of the experiment and data are presented pH (9.32) EC (0.36) and ESP (17.94 %). The experiment was laid out in a Randamized Block Design with three replication.Leaf Area Index was calculated by employing the formula of Williams, 1976.

Result and Discussion

Leaf Area Index

Leaf area Index was found to increase gradually from Vegetative to pod formation stage and decline thereafter towards maturity. Among the treatment combinations T_5 (ST with Cowpea Sprout Extract 2% + foliar spray of Panchagavya -1.0 %) recorded higher leaf area index of 4.54 at pod formation stage which was followed by T_3 (4.43) and T_2 (3.84) recorded higher leaf area index shows the significant difference with control (Table 1). Best performing treatments shows the significance difference with control. Among the treatment combinations T5 recorded higher leaf area index of 4.33 at pod formation stage which was followed by T_3 (4.14) and T_2 (3.53) recorded higher leaf area index in black gram (Table 1.1). The growth hormone showed favorable influence on leaf area due to its relation with phytochrome, which mediated regulation of growth and induced the cell enlargement (sakurai and Fujika, 1993) [5].

Table 1: Effect of growth regulating substances on leaf Area Index of Green gram at sodicity.

Treatments	30 DAS	45 DAS	60 DAS	Mean
T1	2.25	3.44	2.46	2.72
T2	3.00	3.84	3.68	3.51
T3	3.12	4.43	4.14	3.90
T4	2.31	3.56	2.98	2.95
T5	3.32	4.54	4.32	4.19
T6	2.58	3.64	3.11	3.11
Mean	2.76	3.91	3.45	
SED	0.14	0.16	0.13	
CD (0.05)	0.28	0.32	0.26	

Table 1.1: Effect of growth regulating substances on leaf Area Index of Black gram at sodicity

Treatments	30 DAS	45 DAS	60 DAS	Mean
T1	1.18	2.33	1.87	1.79
T2	2.24	3.53	3.32	3.03
T3	2.66	4.14	3.82	3.54
T4	2.33	2.63	2.11	2.36
T5	2.78	4.33	4.14	3.75
T6	2.16	3.22	2.05	2.74
Mean	2.23	3.36	3.02	
SED	0.10	0.15	0.14	
CD (0.05)	0.22	0.34	0.30	

Table 2: Influence of growth regulating substances on yield and yield contributing characters and Na/K ratio in Green Gram at sodicity

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
T1	13.32	7.11	2.50	602	2480	0.24	0.824
T2	17.63	7.78	2.58	660	2618	0.26	0.648
T3	18.22	8.51	2.60	712	2734	0.27	0.602
T4	16.14	7.14	2.53	618	2445	0.25	0.785
T5	19.14	8.78	2.66	803	2888	0.28	0.588
T6	16.74	7.32	2.57	630	2550	0.26	0.738
Mean	17.03	7.77	2.57	671	2612	0.26	0.700
SED	0.76	0.36	0.12	31	121	1.13	0.021
CD (0.05)	1.69	0.80	NS	69	271	2.26	0.045

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 Green gram variety Treatment T_5 recorded higher No of pods/plant (19.14), No of seeds/pod (8.78),100 seed weight (2.66),Biological yield (2888),grain yield (803) and Harvest Index (0.28) followed by treatment T_3,T_2 and T_6 recoded the higher yield under sodicity with control.All the treatments differed significantly in Na/K ratio at Maturity stages. The best performing treatment maintain lowest Na/K ratio. Among the treatments, T_5 registered the lowest Na/K ratio of 0.588 at maturity stage and shows higher tolerance.

Table 2.1: Influence of growth regulating substances on yield and yield contributing characters and Na/K ratio in Black Gram at sodicity

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
T1	7.14	5.02	2.01	508	2118	0.23	0.808
T2	11.82	6.08	2.22	585	2385	0.25	0.753
T3	12.32	6.45	2.33	635	2441	0.26	0.689
T4	9.35	5.65	2.21	520	2213	0.24	0.779
T5	14.12	7.12	2.54	708	2521	0.28	0.641
T6	10.43	5.98	2.11	548	2333	0.24	0.768
Mean	10.86	6.05	2.24	584	2335	0.25	0.740
SED	0.48	0.27	0.10	26	107	0.74	0.040
CD (0.05)	1.08	0.61	NS	59	239	1.45	0.080

In Black gram variety Treatment T_5 recorded higher No of pods/plant (14.12), No of seeds/pod (7.12),100 seed weight (2.54),Biological yield (2521),grain yield (708) and Harvest Index (0.28) followed by treatment T_3,T_2 and T_6 recoded the higher yield under sodicity with control.All the treatments differed significantly in Na/K ratio at Maturity stages. The best performing treatment maintain lowest Na/K ratio. Among the treatments, T_5 registered the lowest Na/K ratio of 0.641 at maturity stage and shows higher tolerance. The increase in dry matter production due to the treatments in the present study is in accordance with the report of Rangasamy *et al* (1993) [4] in agricultural crops.

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