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Response of Foliar Nutrition on Growth and Yield of Urdbean under Rainfed Condition

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Abstract: ***Field Experiment was conducted during October 2018- January 2019 with an objective to enhance growth and yield of Urdbean under rainfed condition thorough foliar fertilization. The experiment was laid out in randomized block design with seven treatments and replicated thrice. The treatment details includes, T_1 – Control (Farmer practice), T_2 – Full RDF, T_3 - 50% RDF and foliar spraying of "Revive plus" @ 2 g litre^{-1} twice at 25 and 50 DAS, T_4 - 50% RDF and foliar spraying of "Revive plus" @ 3g litre^{-1} twice at 25 and 50 DAS,T_5 - 50% RDF and foliar spraying of "1% KCl" twice at 25 and 50 DAS, T_6 – 50% RDF and foliar spraying of "100ppm Salicylic acid" twice at 25 and 50 DAS, T_7 - 50% RDF and foliar spraying of "Orthosilicic acid" @ 2ml litre^{-1} twice at 25 and 50 DAS. The results of the experiments revealed that foliar application of different chemicals significantly influenced the growth, yield attributes and yield. Among the various treatments tried, T_4 - "Revive plus" @ 3g litre^{-1} twice at 25 and 50 DAS recorded maximum values for growth and yield attributes viz., plant height, LAI,DMP, root length and chlorophyll content and yield attributes viz., number of pods plant^{-1}, number of seeds pod^{-1}, test weight, seed yield and haulm yield and harvest index. The lowest values for growth and yield attributes and yield were recorded in T_1 – Control treatment.***

Keywords: Urdbean, foliar nutrition, growth, yield, rainfed

1. Introduction

Drought has been a recurring feature of agriculture in India. In the past, India experienced twenty four large scale droughts in with increasing frequencies during the periods 1891-1920,1965-1990 and 1999- 2012 (NRAA, 2013). Long-term rainfall data for India indicates that rainfed areas experience 3-4 drought years in every 10 year period. Of these, two to three are in moderate and one or two may be of severe intensity (Srinivasa Rao *et al.,* 2013). Occurrence of the drought is very frequent in the meteorological sub divisions like West Rajasthan, Tamilnadu, Jammu & Kashmir and Telengana (NRAA, 2013). The risk involved in successful cultivation of crops depends on the nature of drought (chronic and contingent), its duration, and frequency of occurrence within the season. The term rainfed agriculture is used to describe farming practices that solely depend on rainfall for water. It provides much of the food consumed by poor communities in developing countries. Rainfed crop cover more than 80% of global cropped area and account for 60-70% of global crop production, but production is frequently limited by drought and soil moisture stress (Wood *et al.,* 2000). In India around 65-70% of cultivated lands coming under rainfed drylands and they contributing about 45% of nations food grain production. Most of the crops belongs to millets (>95%), oilseeds (90%) and pulses 90-95% are cultivated on these lands with low productivity. The reasons attributed to low productivity may be inadequate rainfall, poor soil fertility, occurrence of dry spells drought during cropping season, high temperature, more PET than rainfall etc.,. Of these drought at critical period crops season drastically reduces the crop yield. The effect of water stress was found to decrease significantly in photosynthetic rate (Hejank, 2003) transpiration rate (Gupta *et al.,* 2003) chlorophyll stability index stomata conductance and relative water content (Gupta *et al.,* 2003). Crops such as millet, foxtail, sorghum and cowpea are also grown in the arid and semi-arid areas affected by drought stress at the reproductive stage (Emam and Zavorakh, 2004). The All India coordinated Research Project for Dryland Agriculture (AICRPDA) in association with state Agricultural universities, Technical Universities and Research Institutes of Indian council of Agricultural Research have developed location-specific rainfed technologies to cope with different drought situations. The key technologies for drought mitigation are in situ moisture conversation, rainwater harvesting and recycling, resilient crops and cropping systems including contingency crop plant, foliar spraying, integrated farming system etc., (Srinivasa Rao *et al.,* 2014). Among these dryland technologies foliar spraying of nutrients and anti-transpirants found to be effective in mitigating drought moisture stress during cropping seasons. Indian agriculture has been achieved to some extend due to improved practices, better logistics and timely interventions from central and state government during drought years. However, rainfall aberrations including drought during south-west monsoon continue to be major factors contributing to instability in crops production in rainfed areas. Hence, there is a need to make rainfed areas more resilient through adoption of drought proofing technologies.

2. Materials and Methods

The Field Experiments were conducted during October-2018 to January-2019 at the farmer's field at Kunjaram village in Ulundurpet Taluk of Villupuram District, Tamil Nadu. The experimental site is situated at 11°41′26″N latitude, 79°17′30″E longitude with an altitude of 66 m above mean sea level. The texture of the experimental field soil is sandy loam which is low in available nitrogen, high in available phosphorus and high in available potassium content. Urdbean VBN5 variety was chosen for this study. The experiment consisted of seven treatments and was laid out in Randomized Block Design with three replications. The treatments imposed in the experiment with different chemicals viz., T_1- Control (Farmer's practice), T_2 - RDF 12.5:25:12.5 Kgs of NPK ha^{-1}, T_3 - 50% RDF and foliar spraying of Revive plus @ 2g $litre^{-1}$ at 25 DAS and 50 DAS, T_4 -50% RDF and foliar spraying of Revive plus @ 3g $litre^{-1}$ at 25 DAS and 50 DAS, T_5 -50% RDF and foliar spraying of 1% KCl at 25 DAS and 50 DAS, T_6 -50% RDF and foliar spraying of 100ppm Salicylic acid at 25 DAS and 50 DAS and T_7 -50% RDF and foliar spraying of Orthosilicic acid @ 2ml $litre^{-1}$ at 25 DAS and50 DAS. The recommended dose of 12.5:25:12.5 kgs of NPK ha^{-1} for Urdbean varieties were applied in the form the urea (46 % N), DAP (18 % N and 46 % P_2O_5) and MOP (60% K_2O) respectively. Fertilizers were applied fully as basal.

3. Results and Discussion

Growth attributes (Table 1)

Among the various foliar nutrition, foliar spray of Revive plus @ 3g $litre^{-1}$ (T_4) registered the higher plant height, LAI, DMP, chlorophyll content and root length of Urdbean and it was comparable with foliar spraying of Revive plus @ 2g $litre^{-1}$ (T_3) but superior to other foliar fertilization. Increased in plant height might be due to enhanced level of nutrient availability in the Rhizo-ecosystem of the foliar applied nutrients resulting in better plant growth and development. Application of nutrients would have resulted in better vegetative growth as observed by taller plants, more branches and efficient nodulation. This favorable influence of foliar application of nutrients could be ascribed to more and quick access to nutrients by plants at seedling and early development stages. Increased leaf area index and dry matter production might be due to increased availability of nutrients to plants leading to maximum plant growth in terms of plant height and leaf area which in turn contributed higher DMP production. During this study we examined that these results also resembled the findings of Uma Maheshwari and Karthik (2017) and Deepak Kumar *et al.* (2018). The increased chlorophyll content might be due to the fact that of nitrogen is a constituent of chlorophyll molecule which is expected during rapid grain filling leaves. This was evidenced through the studies of Sritharan *et al.* (2005).

Yield attributes and yield (Table 2)

Among the treatments tried, foliar spray of Revive plus @ 3g $litre^{-1}$ (T_4) recorded the higher number of pods $plant^{-1}$, number of seeds pod^{-1}, test weight, seed yield, haulm yield and harvest index of Urdbean and it was comparable with foliar spraying of Revive plus @ 2g $litre^{-1}$ (T_3) but superior to other foliar fertilization. Increased pods $plant^{-1}$, number of seeds pod^{-1} and test weight with foliar nutrition might be due to balanced growth habit, which induced more flower and fruiting body production with timely supply of nutrients through foliar spray might have reduced shedding of flowers and fruits, which led to a positive source-sink gradient of photosynthates translocation due to foliar application of nutrients in pulses. The finding is in line with the results of Uma Maheshwari and Karthik (2017). Foliar application of nutrients increased the grain yield and thereby resulting increased HI values. This is agreement with the findings of Vijaysingh Thakur *et al.* (2017) who reported that the increased HI might be due to the increased mobilization of metabolites to reproductive sinks in Urdbean.

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Table 1: Effect of foliar fertilization of different chemicals on growth attributes of Urdbean

Treatments	Plant height(cm) At harvest stage	LAI at flowering stage	DMP (Kg ha^{-1}) at harvest stage	Chlorophyll content (mg g^{-1}) at flowering stage	Root length (cm) at harvest stage
T_1	66.04	3.34	3318.87	42.69	27.1
T_2	67.02	3.84	3445.54	43.95	28.0
T_3	69.45	4.52	3609.61	45.88	28.9
T_4	69.98	4.93	3654.25	46.06	29.1
T_5	68.08	4.03	3512.24	44.65	28.4
T_6	66.89	3.62	3399.8	43.28	27.5
T_7	68.76	4.28	3585.80	45.02	28.6
SE.d	1.34	0.11	68.05	0.87	0.48
CD(p=0.05)	2.93	0.24	148.27	1.90	1.04

Table 2: Effect of foliar fertilization of different chemicals on yield and yield attributes of Urdbean

Treatments	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed yield (Kg ha^{-1})	Haulm yield (Kg ha^{-1})	Harvest index (%)
T_1	12.6	6.2	3.4	776.33	2342.66	24.89
T_2	13.0	7.0	3.65	936.50	2517.33	27.11
T_3	14.0	7.8	3.85	1057.66	2719.33	28.00
T_4	14.2	8.0	3.90	1173.83	2787.33	29.63
T_5	13.4	7.2	3.70	981.33	2597.33	27.42
T_6	12.8	6.6	3.60	932.16	2449.33	27.56
T_7	13.6	7.4	3.80	1014.16	2655.66	27.63
SE.d	0.33	0.16	0.07	22.73	52.16	0.99
CD(p=0.05)	0.72	0.36	0.16	49.53	113.65	2.17