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Mitigation of adverse effects of drought on production of blackgram by foliar application of potassium nitrate

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Abstract
Effects of foliar spray of KNO_3 (200ppm) on number of pod per plant, seed weight under moisture stress were studied in Black gram. Plants were subjected to mild, moderate and severe water stress which was created by withholding irrigation. The result indicates that moisture stress adversely affected dry matter and yield. Detrimental effect of water stress on yield were less in plant grown at 200ppm KNO_3. The yield increased 2-3 folds as compared to control in water deficit condition at 35DAS.The detrimental effects of water stress on Black gram were markedly less in K-fed plants. It is concluded that K-application helped plants in maintaining favourable internal tissue moisture and metabolic activities under water stress.

Keywords: *Vigna mungo*, KNO_3

1. Introduction
Water is one of the most vital natural resource of the world. According to UNO, water crisis is the major threat for mankind in 21st century. Among the various abiotic stresses, water deficit is the major factor that limits crop productivity worldwide, Moreover, it was also predicted that by the year 2025, one-third of the world's population would be living in regions experiencing severe water scarcity.
About 40% of the total world population suffer from protein malnutrition and situation being more alarming in a developing country like India. Since, pulse which is rich in proteins form a major portion of the normal Indian diet, In India pulses are mainly grown under rain fed condition on poor soil with low input. A special attention has to be given for enhancing their production to make them available at cheaper rate to all the sections of the society.
Approximately 72% of the cultivated land in India is rainfed largely due to poor monsoon and extended dry condition, resulting in reduced crop growth. Generally pulses are very susceptible to water stress (Agele *et al*. 2006) [1].
Pulses gained importance in the global agriculture for their high protein content and also for their inherent capability of fixing atmospheric nitrogen through symbiotic root nodule bacteria of the genus *Rhizobium.*
Among the pulses *Vigna mungo* (L.) *Hepper* or Blackgram (Urd) is the most important pulse crop having protein content 24-28% being sown commonly as mixed crop subsidiary to cotton, maize or jowar.
Urad dal is a prebiotic food due to its high content of amylose starch. "Pribiotics" is food ingredients which cannot be digested with our normal digestive process but require the help of stomach bacteria to digest it. It also stimulates growth of good bacteria in the digestive system.
The production of the urad could not be increased per unit area because even today 60-70% of the crops is grown under rainfed condition on poor soil with low input.
Increasing stress progressively and significantly decreased concentration of nitrogen, phosphorus and potassium. The availability of nutrients in the soil is not only prerequisite for optimum crop growth but also help plants to ameliorate the adverse effects of water stress. Potassium, being a major plant nutrient, which influences the water economy and crop growth through its effects on water uptake, root growth, maintenance of turgor, transpiration and stomatal regulation.

2. Objectives
1. Study the effect of water stress on seed yield of the test crop *Vigna mungo.*
2. Examine the effect of foliar application of 200ppm KNO_3 under simulated water stress.

3. Material and Method
Surface sterilized seed of Blackgram T-9 variety were inoculated with 96 hr. grown culture of *Rhizobium phaseoli* and then grown in earthenware pots containing garden soil supplied with Hoagland's nutrient solution weekly.
The plants were subjected to mild, moderate and severe water stress by withholding water irrigation for 1, 3, 5 and 7 days respectively. Plants were subjected to three conditions.
1. Control plants were watered at regular intervals
2. Stress plants by withholding water supply.

Stress plants with foliar application of 200ppm KNO_3.Stress was imposed from 15DAS to 75DAS.

The plants were harvested after 90 days and the following parameters were studied for yield.
1. Pod number per plant.
2. Weight of 1000 seeds.

4. Result and Discussion

Table 1: Vigna mungo: Number of pods/plant and Seed weight gm/100 seeds in black gram under water stress (day) and also treated with KNO_3.

Water Treatment (days)	No. of pods/plant		Weight of gm/100 seed	
	Without treatment	With KNO3	Without treatment	With KNO3
Control	44±0.46*	52±0.13*	4.1±0.40*	4.52±0.37*
1 Day	41±0.13	49±0.03	3.76±0.75	4.19±0.67
3 Days	34±0.04	47±0.08	3.59±0.47	4.05±0.44
5 Days	32±0.04	43±0.06	3.48±0.44	3.86±0.65
7 Days	30±0.09	41±0.06	3.3±0.36	41±0.06

Yield attributing parameters like number of pod per plant, seed weight, were studied in T9 variety. The result indicates that moisture stress adversely affected dry matter and yield. Though moisture was the limiting factor but this could be overcome to a certain extent by potassium application in all the situation. (Mengel and Brunschweig 1972) [4] have also reported the significance of potassium under dry conditions. Similarly Rama Rao (1986) [5] also observed favourable effects of potassium on pearl-millet yield under moisture stress situations. Yield improvement due to potassium application in number of crops have been reported (Sharma *et al*. 1992, Umar *et al*. 1993) [6, 8]. Mengel and Kirkby (1980) [3] suggested that under low soil moisture, K-application may result in yield improvement. Singh *et al* (1997) [7] reported favourable effects of potassium applications on chickpea yield under water stress at various developmental stages.

The result of the present investigation indicates that water stress has adverse effect on yield of the test plant *Vigna mungo*. Applied K mitigates the adverse effects of water stress in Black gram by favourably influencing internal tissue moisture photosynthetic rate and nitrogen metabolism. KNO_3 have better impact on mitigating stress because interaction of N and K during formative phases and seed-filling stages give higher yield. (Majumdar *et al*. 1980) [2] The extent of change in any plant process mainly depends on the severity and duration of water stress and also on the stage of plant development when the water stress has occurred. (Kramer, 1983) [9]. The present investigation indicates that applied K mitigates the adverse effects in this variety by favourably influencing internal tissue moisture, photosynthetic rate and nitrogen metabolism.

5. References

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