Journal of Research in Ecology

An International Scientific Research Journal

ISSN No: Print: 2319 –1546; Online: 2319– 1554

Journal of Research in Ecology

Original Research

Influence of water stress and potassium fertilizer on mungbean

Authors:
Zohre Zoraghi,
Hamid Reza Ganjali and
Hamid Reza Mobasser

Institution:
Department of Agronomy, Islamic Azad University, Zahedan Branch, Zahedan, Iran.

Corresponding author:
Hamid Reza Ganjali

ABSTRACT:

Water shortage and the increasing competition for water resources between agriculture and other sectors compel the adoption of irrigation strategies in semi-arid Mediterranean regions, which may allow saving irrigation water and still maintain satisfactory levels of production. Mungbean is a warm season crop requiring 90–120 days of frost free conditions from planting to maturity. The field experiment was laid out in factorials with randomized complete block design with three replications. Treatments included water stress involving control (I1), 6 days once (I2), 9 days once (I3) and potassium fertilizer including control (K1), 75 Kg/ha (K2), 150 Kg/ha (K3) and 225 kg/ha (K4). Analysis of variance showed that the effect of water stress and potassium fertilizer on all characteristics were significant. The maximum of all characteristics of treatments except control were obtained. The minimum of all characteristics of treatments were obtained in 9 days once treatments.

Keywords:

Biological yield, Grain yield, Harvest index

Email Id:

hr.ganjali@gmail.com

Article Citation:

Zohre Zoraghi, Hamid Reza Ganjali and Hamid Reza Mobasser

Influence of water stress and potassium fertilizer on mungbean

Journal of Research in Ecology (2017) 5(1): 433-439

Dates:

Received: 13 Dec 2016 **Accepted:** 08 Jan 2017 **Published:** 10 Feb 2017

Web Address:

http://ecologyresearch.info/documents/EC0238.pdf

INTRODUCTION

Dry season issues for mungbeans are declining with the fast development of water focused on regions of the world with a predict of three billion individuals at 2030 (Postel, 2000). Sufficient precipitation is required from blossoming to late unit taking care of keeping in mind the end goal to guarantee great yield. Edit yield of mungbean is more reliant on a satisfactory supply of water than on whatever other single natural element (Kramer and Boyer, 1997). Among the ideal characters of developing mungbean in here and now development, nitrogen obsession capacity, soil fortification and anticipation of soil disintegration are at the considerable statures. Mungbean is well known as an intercrop, or as blended harvest with money crops. The rice-wheat editing framework is honed on 26 million ha in South and East Asia (Timsina and Connor, 2007).

Water deficiency and the expanding rivalry for water assets amongst farming and different areas force the selection of water system techniques in semi-dry Mediterranean districts, which may permit sparing water system water and still keep up agreeable levels of creation (Costa *et al*., 2007). The development, improvement and spatial appropriation of plants are extremely confined by an assortment of natural anxiety. Among various issues confronted by harvest plants, water stress is thought to be the most basic one (Boyer, 1982; Soriano *et al*., 2004; Sinclair, 2005). Lack of water, the most imperative segment of life, points of confinement plant development and yield efficiency, especially in parched districts more than whatever other abiotic ecological variable (Boyer, 1982).

Water shortage impacts have been widely contemplated on a few products, for example, maize (Achakzai, 2008), sorghum (Achakzai, 2007; 2009a, b), sugar beet and hot pepper (Dorji *et al.,* 2005), and so on. Lessened precipitation together with the higher evapo-transpiration is relied upon to subject common and rural vegetation to a more serious danger of dry spell in those ranges (Samarakoon and Gifford, 1995). Water is basic at each phase of plant development and rural efficiency is exclusively needy upon water particularly, from seed germination to plant development (Turner, 1991). Dry spell stress is a standout amongst the most imperative abiotic stretch components which are by and large joined by warmth worry in dry season (Dash and Mohanty, 2001). Because of water deficiencies, the physiology of product is irritated which causes countless in the morphology and life structures of plants. Dry spell stress is a noteworthy restricting component for plant development and improvement worldwide and, in Iran, as well. Sunflower is a very much adjusted dry season trim, basically in light of the intense water take-up because of its effective root framework (Belhassen, 1995). In any case, it has been found that both amount and conveyance of water significantly affects seed yield and seed quality in sunflower (Krizmanic *et al*., 2003; Iqbal *et al*., 2005). Force of yield diminishment by dry spell push relies on upon the development phase of a product, the seriousness of the dry spell and resistance of genotype. Petcu *et al.* (2001) demonstrated that grain yield of sunflower crossovers were influenced by dry season worry with the low status treatment yielding 10-13% not as much as the control treatment. Igbal *et al.* (2005) announced a pattern in yield decay and diminish of yield segments because of water stress medications. Razi and Asad (1998) showed that dry spell worry at blooming stage was seen to be a restricting variable for seed filling; so noteworthy diminishment of unfilled seeds were seen therefore of no water system. Diminishing water supply either incidentally or for all time influences morphological, physiological and even biochemical procedures in plants unfavorably (Achakzai, 2007; 2008; 2009a, b). D'Andria *et al*. (1995) announced that the capacity of sunflower to concentrate water from more profound soil layers as "when water worry amid the early vegetative stage causes incitement of more profound root framework" and a resistance of brief times of water shortfall, are valuable attributes of sunflower for delivering satisfactory yields in dry land cultivating.

Then again, a few confirmations have demonstrated that water push deficiency causes significant lessening in the yield and oil substance of sunflower (Stone *et al.,* 2001). In spite of the fact that a great deal of writing is accessible about water stretch consequences for sunflower (Wise *et al*., 1990, Tahir and Mehdi, 2001; Angadi and Entz, 2002), data in regards to the impact of typically inundated and water shortage condition on seed yield, yield segment, seed oil and protein substance is by and by looked into in our research center to find out the present situation.

MATERIALS AND METHODS

The field experiment was conducted during spring and summer 2016 in the research field of Khash located at the Sistan and Balouchestan provinces of Iran. Khash region is situated between 27° North and 60° East. The objective of this investigation was to study the influence of water stress and potassium fertilizer on some characteristics of mungbean. Seeds of local mungbean cultivar were purchased from the Khash. Soil (depth of 0–30) samples were taken in order to determine the physical and chemical properties. Soil properties of field were: pH 7.15 (1:2.5 in water), 1.12% Organic Matter (OM), 0.16% total Nitrogen, 8.32 mg Kg^{-1} Olsen P, 262 mg Kg^{-1}, 0.889 mg kg^{-1} Zn and 62.3 mg kg^{-1} Fe and clay-loam texture (30% sand, 40% clay and 30% silt). This study was a factorial randomized complete block design with three replications. Treatments included water stress are control (I1), 6 days once (I2), 9 days once (I3) and potassium fertilizer including control (K1), 75 Kg/ha (K2), 150 Kg/ha (K3) and 225 Kg/ha (K4). Irrigation was proceeded according to the proposed design throughout the growing season. An identical basic dose of 30 Kg nitrogen per hectare was practiced and blended with the dirt during seedbed preparation to all piece. Phosphorous fertilizer was practiced at the time of planting. Entire other agricultural practices were accomplished equally within the growth season. Weeds were manually eradicated whenever they were observed in the field. In physiological maturity to determine the harvest index, 8 plants of each plot were harvested and using the following formula, harvest index was calculated.

Harvest index: Economic yield/ Biological yield

To measure the biological yield, eight plants of each piece were harvested and kept in an oven at 75° C for 48 hours. After weighing samples, biological yield was calculated based on 12% moisture (Kozak and Madry, 2006; Kozak *et al.,* 2007). Plant height is calculated from the soil surface to the tip of the tallest plant using a ruler.

The data collected in this study were subjected to Analysis of Variance (ANOVA) using the general linear model method in the Statistical Analysis System and the means analogy was done through an LSD test using a SAS statistical package.

RESULTS AND DISCUSSION

Harvest index

Analysis of variance showed that the effect of

Table 1. Anova analysis of the mungbean affected by water stress and potassium fertilizer

SOV	df	Harvest Index (%)	Grain yield (Kg/ha)	Biological yield (Kg/ha)	Plant height (cm)
R	2	27	3640.8	82892.4	1.36
Water stress (I)	3	82.75*	35315.1**	298229.6*	17.42**
Potassium fertilizer (K)	2	94.55*	44139.6**	21723727**	4.16**
I*K	6	121.08**	70874.08**	1366126.5**	7.22**
Error	22	22.78	3142.6	64929.7	0.81
CV	-	20.02	13.65	7.28	4.09

*, **, ns: significant at $p<0.05$ and $p<0.01$ and non-significant respectively.

Table 2. Comparison of different traits affected by water stress and potassium fertilizer

Treatment	Harvest Index (%)	Grain yield (Kg/ha)	Biological yield (Kg/ha)	Plant height (cm)
Water stress				
Control	26.41[a]	453.08[a]	3682.1[a]	23.41[a]
6 days once	23.91[ab]	429.25[a]	3410.4[b]	21.62[b]
9 days once	21.16[b]	349.50[b]	3407.7[b]	21.12[b]
Potassium fertilizer				
Control	20.55[b]	334.78[c]	1644.9[d]	21.27[c]
75 Kg/ha	21.55[b]	396.11[b]	2975.9[c]	21.72b[c]
150 Kg/ha	26.88[a]	504.11[a]	5278.9[a]	22.77[a]
225 Kg/ha	26.33[a]	407.44[b]	4100.6[b]	22.44a[b]

Any two means not sharing a common letter differ significantly from each other at 5% probability

water stress on harvest index was significant (Table 1). The maximum of harvest index for treatments and control were obtained 26.41 (Kg/ha) (Table 2). The minimum of harvest index was obtained in the treatment '9 days once' (Table 2). Analysis of variance showed that the effect of Potassium fertilizer on harvest index was significant (Table 1). The maximum harvest index was obtained in 150 Kg/ha (Table 2). Comparable review of results were obtained by Haqqani and Pandey (1994), who showed that water stress decreased harvest index, pod number and 1000 seed weight of mungbean but higher yield was obtained by biofertilizer application. Thomas *et al.* (2004) reviewed that mungbean plants in the rain shelter and rainfed treatments attained maturity earlier than the well-watered treatment. Jouany *et al.* (1996) found that Potassium fertilization gave higher yield than the control.

Grain yield

Analysis of variance showed that the effect of water stress on grain yield was significant (Table 1). The maximum grain yield was obtained in control 453.08 (Kg/ha) (Table 2). The minimum grain yield was obtained in '9 days once' treatment (Table 2). Analysis of variance showed that the effect of potassium fertilizer on grain yield was significant (Table 1). The maximum grain yield was obtained in '150 kg/ha' treatment (Table 2). The minimum grain yield was obtained in control 334.78 (Kg/ha) (Table 2). Decreasing water supply either temporarily or permanently affects morphological and physiological and even biochemical processes in plants adversely (Achakzai, 2007; 2008; 2009a, b). Water stress is one of the maximum significant stress factors which is a common companion of warm stress in dry countries (Dash and Mohanty, 2001). In drought stress, the physiology of plant is damaged which causes a number of changes in the physiology of the crops. Water deficit is a main factor for plant development in Iran. *Helianthus annus* is a adapted crop, because of the strong water absorbing capability. (Belhassen, 1995).

Biological yield

Analysis of variance showed that the effect of water stress on biological yield was significant (Table 1). The maximum of biological yield were obtained for control treatments 3682.1 (Kg/ha) (Table 2). The minimum of biological yield was obtained on '9 days once' treatment. Analysis of variance showed that the effect of Potassium fertilizer on biological yield was significant (Table 1). The maximum of biological yield of treatments was obtained on 150 Kg/ha treatment (Table 2). The minimum of biological yield was obtained on control 1644.9 (Kg/ha). In any case, it has been found that both amount and dispersion of water significantly affects natural yield and seed quality in sunflower (Krizmanic *et al.,* 2003; Iqbal *et al.,* 2005). Power of yield decrease by dry season push relies on upon the development phase of the harvest, the seriousness of the dry season and resilience of genotype. Petcu *et al*. (2001) demonstrated that grain yield of sunflower mixtures was influenced by dry season worry with the low status treatment yielding 10 -13% not as much as the control.

Plant height

Analysis of variance showed that the effect of water stress on plant height was significant (Table 1). The maximum plant height was obtained on control 23.41 (Kg/ha) (Table 2). The minimum plant height was obtained on '9 days once' treatment (Table 2). Analysis of variance showed that the effect of potassium fertilizer on plant height was significant (Table 1). The maximum plant height was obtained on '150 Kg/ha' treatment (Table 2). The minimum plant height was obtained on control treatment 21.27 (Kg/ha) (Table 2). Drought stress is a standout amongst the most essential abiotic stretch elements which are by and large joined by warmth worry in dry season (Dash and Mohanty, 2001). Because of water deficiencies, the physiology of harvest is bothered which causes expansive number of changes in the morphology and life systems of the plant. Dry season stress is a noteworthy constraining variable for plant development and improvement in Iran and in different nations as well. Sunflower is a very much adjusted dry season edit, basically on account of the capable water take -up because of its effective root framework (Belhassen, 1995).

Water stretch additionally influences edit phenology, leaf region improvement, blooming, case setting lastly brings about low yield. The vegetative development of mungbean generally stops at the onset of the regenerative stage; the product can create second flushes of blooms if conditions are good (Ludlow and Muchow, 1990).

Potassium is related with development of water, supplements, and sugars in plant tissue. Potassium is included in compound enactment inside the plant which influences protein, starch and Adenosine Tri Phosphate (ATP) creation. The generation of ATP can direct the rate of photosynthesis. Potassium additionally directs the opening and shutting of the stomata which controls the trading of water vapor, oxygen, and carbon dioxide. In the event that potassium is insufficient or not provided in satisfactory sums, development is hindered and yield is diminished.

CONCLUSION

The results of the present study showed that the effect of drought stress was significant on all traits. With increasing drought stress, there was significant difference between treatments in all evaluated traits ($p<0.01$). With increasing drought stress, harvest index, grain yield, biological yield and plant height were decreased. The maximum of all traits was obtained in control treatment and minimum of them was obtained at 9 days once treatment. Moreover, the effect of potassium fertilizer was also significant on all traits. With increasing potassium fertilizer, there was significant difference between treatments in all evaluated traits ($p<0.01$). With increasing level of potassium fertilizer, harvest index, grain yield, biological yield and plant height were increased.

REFERENCES

Abdul Kabir Khan Achakzai. (2007). Effect of water potential on uptake and accumulation of cations by sorghum seedlings. *Journal of Chemical Society of Pakistan,* 29(4):321-327.

Abdul Kabir Khan Achakzai. (2008). Effect of water stress on cations accumulation by maize seedlings (*Zea mays* L.). *Journal of chemical Society of Pakistan,* 30 (2):271-275.

Abdul Kabir Khan Achakzai. (2009 a). Effect of water stress on imbibition, germination and seedling growth of maize cultivars. *Sarhad Journal of Agriculture,* 25(2):165 -172.

Abdul Kabir Khan Achakzai. (2009 b). Effect of water potential on seedling growth of sorghum cultivars. *Sarhad Journal of Agriculture,* 25(3):385-390.

Angadi SV and Entz MH. (2002). Root system and water use patterns of different height sunflower cultivars. *Agronomy Journal*, 94 (2):136-145.

Belhassen E. (1995). An example of interdisciplinary drought tolerance study. Looking for physiological and molecular markers of low cuticular transpiration. *Journal of Plant Physiology,* 120 (6): 721-734.

Boyer JS. (1982). Plant productivity and environment. *Sciences Journal,* 218 (4):443-448.

Costa JM, Ortun OMF and Chaves MM. (2007). Deficit irrigation as a strategy to save water: physiology and potential application to horticulture. *Journal of Integrative Plant Biology,* 49(9):1421-1434.

D'Andria R, Chiaranda FQ, Magliulo V and Mori M. (1995). Yield and soil water uptake of sunflower sown in spring and summer. *Agronomy Journal,* 87(6):1122-1128.

Dash S and Mohanty N. (2001). Evaluation of assays for the analysis of thermo tolerance and recovery potentials of seedlings of wheat (*Triticum aestivum* L.) cultivars. *Journal of Plant Physiology,* 158(3):1153-165.

Dorji K, Behboudian MH and Zegbe-Domınguez JA. (2005). Water relations, growth, yield, and fruit quality of hot pepper under deficit irrigation and partial root zone drying. *Scientia Horticulturae,* 104(2):137-149.

Haqqani AM and Pandey RK. (1994). Response of mungbean to water stress and irrigation at various growth stages and plant densities: II. Yield and yield components. *Tropical Agriculture,* 71(4):289-294.

Iqbal N, Ashraf MY and Ashraf M. (2005). Influence of water stress and exogenous glycine betaine on sunflower achene weight and oil percentage. *International Journal of Environmental Sciences and Technology,* 5(2):155-160.

Jouany C, Colomb B and Bosc M. (1996). Long-term effects of potassium fertilization on yields and fertility status of calcareous soils of south-west France. *Field Crops Research,* 5(3):287-294.

Kramer PJ and JS Boyer. (1997). Water relations of plants and soils, Academic Press. *Agronomy Journal,* 2(1):170-193.

Krizmanic M, Liovic I, Mijic A, Bilandzi M and Krizmanic G. (2003). Genetic potential of OS sunflower hybrids in different agroecological conditions. *Sjemenarstvo Journal,* 20(4):237-245.

Kozak M and Mądry W. (2006). Note on yield component analysis. *Cereal Research Communications*, 34(2−3), 933−940.

Kozak M, Samborski S, Kang MS and Rozbicki J. (2007). Applying statistics for non sequential yield component analysis. *Plant, Soil and Environment*, 53(10), 456−463.

Ludlow MM and Muchow RC. (1990). A critical evaluation of traits for improving crop yields in water-limited environments. *Advances in Agronomy,* 43(3): 107-153.

Petcu E, Arsintescu A and Stanciu D. (2001). The effect of hydric stress on some characteristics of sunflower plants. *Romanian Agricultural Research,* 16(1):15-22.

Postel SL. (2000). Entering an era of water scarcity. The challenges ahead. *Ecological Applications,* 10(3):941-948.

Razi H and Asad MT. (1998). Evaluation of variation of agronomic traits and water stress tolerant in sunflower conditions. *Agricultural and Natural Resources Sciences,* 2(2):31-43.

Samarakoon AB and Gifford RM. (1995). Soil water content under plants at high CO_2 concentration and interaction with the treatment CO_2 effect a species comparison. *Journal of Biogeography,* 22(2):193-202.

Sinclair TR. (2005). Theoretical analysis of soil and plant traits influencing daily plant water flux on drying soils. *Agronomy Journal,* 97(7):1148- 1152.

Soriano MA, Orgaz F, Villalobos FJ and Fereres E. (2004). Efficiency of water use of early plantings of sunflower. *European Journal of Agronomy,* 21(6):465-476.

Stone L, Goodrum RDE, Jafar MN and Khan AH. (2001). Rooting front and water depletion depths in grain sorghum and sunflower. *Agronomy Journal,* 1(2):105-1110.

Tahir MHN and Mehid SS. (2001). Evaluation of open pollinated sunflower (*Helianthus annuus* L.) populations under water stress and normal conditions. *International Journal of Agriculture and Biology,* 3(2):236-238.

Thomas R, Robertson MJ and Fukai S. (2004). The effect of timing and severity of water deficit on growth, development, yield accumulation and nitrogen fixation of mungbean. *Field Crops Research,* 869(1):67-80.

Timsina J and Connor DJ. (2001). Productivity and management of rice-wheat cropping systems: Issues and challenges. *Field Crops Research,* 69(2):93-132.

Turner LB. (1991). The effect of water stress on the vegetative growth of white clover (*Trifolium repens* L.). Comparison of long-term water deficit and short-term developing water stress. *Journal of Experimental Botany,* 42 (3):311-316.

Wang Q, Cui J, Wang X, Zhang T, Zhou H, Hu T and Han J. (2012). Algorithmic models of seed yield and its components in smooth brome grass (*Bromus inermis* L.) via large sample size under field conditions. *Euphytica*, 185(3): 363–375.

Wise S, Gardner W, Sabelman E, Valainis E, Wong Y, Glass K, Drace J and Rosen J. (1990). Evaluation of a fiber optic glove for semi-automated goniometric measurements. *Journal of Rehabilitation Research and Development ,* 27(4):411-24.