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Original Research

Effect of salicylic acid and irrigation period on some characteristics of mung bean

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ABSTRACT:

Plants are exposed to different environmental stresses, all affecting growth, which consequently prevent the yield of plants. Water stress affects plant growth and development with substantial decrease in crop growth rate and biomass reposition. A field experiment was conducted with randomized complete block design with three replications. Treatments included salicylic acid at control (I_1), 25, 50 and 100 ppm, and irrigation period at: 6 days once, 9 days once and 12 days once along with a control. Analysis of variance showed that the effect of salicylic acid on grain yield, dry forage yield, wet forage yield and Plant height were significant. The maximum characteristics of treatments in 50 ppm were obtained. The minimum of treatments were obtained in control. Analysis of variance showed that the effect of irrigation period on grain yield, dry forage yield, wet forage yield and plant height were significant. The maximum of all characteristics were obtained in the six days once treatment. The minimum characteristics were obtained in 12 days once treatment.

Keywords:

Grain yield, Dry forage yield, Wet forage yield, Plant height

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INTRODUCTION

Salicylic Acid (SA) belongs to phenolic compound and is an endogenous growth regulator which participates in the regulation of physiological processes in plants such as seed germination, fruit yield, glycolysis, flowering and heat production in thermo genic plants (Delavari *et al.,* 2010). Ion uptake and transport (Harper and Balke, 1981), photosynthesis rate, stomatal conductivity and transpiration (Khan *et al.,* 2003) could also be affected by salicylic acid application. Various methods of salicylic acid application have been shown to shelter various crop species despite abiotic stress by compelling a wide range of processes afoul in stress tolerance mechanisms (Horvath *et al.,* 2007). Agarwal *et al.* (2005) demonstrated the increase chlorophyll levels and Relative water content as well as the reduce hydrogen peroxide (H_2O_2) and lipid peroxidation when the wheat leaves were treated with salicylic acid under drought conditions. Application of salicylic acid significantly increased growth parameters, photosynthetic pigments and proline content and decreased lipid peroxidation in sweet basil under salinity stress condition (Delavari *et al.,* 2010). However, to get maximum benefit of these crops, their production and postharvest handling technologies need to be optimized.

Currently, there is dire need to standardize agro-techniques for potential cut flower crops for different regions, which are most suitable to local climatic and edaphic conditions (Ahmad *et al.,* 2008). Water stress problems for plants are worsening with the quick expansion of water stressed areas of the world with a anticipate of three billion people at 2030 (Postel, 2000). Sufficient rainfall is required from flowering to late pod filling in order to ensure growth and development. Plant growth is more dependent on an adequate supply of water than on any other alone environmental factor (Paul and John, 1997). Among the favorable characters of growing mung bean in short-term growth nitrogen fixation capability, soil reinforcement and prevention of soil erosion are at the great heights. Mung bean is popular as an intercrop or as mixed crop with cash crops. The rice-wheat cropping system is practiced on 26 million hectare in South and East Asia (Timsina and Connor, 2007). 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 (Costa *et al.,* 2007). The growth of crops is severely surrounded by a diversity of environmental stresses. Between different problems faced by plants, drought is considered to be the most exigent one (Boyer, 1982; Soriano *et al.,* 2004).

Drought, the most main component of life, limits crop growth and crop yield, exclusively in arid regions more than any other abiotic environmental factor (Boyer, 1982). Drought effects have been extensively studied on different crops such as sugar beet and hot pepper (Dorji *et al.,* 2005). Decrease rainfall together with the higher evapo-transpiration is expected to subject natural and agricultural vegetation to a greater risk of water stress in those areas (Samarakoon and Gifford, 1995). Water is essential at every stage of plant growth and agricultural productivity is solely dependent upon water especially, from seed germination to plant maturation (Turner, 1991). Water stress is one of the main important abiotic stresses which are commonly accompanied by heat stress in arid season (Dash and Mohanty, 2001). Due to drought stress, the physiology of plant is damaged which causes a large number of changes in the morphology and anatomy of crops. Water stress is a main limiting factor for plant yield worldwide. Sunflower is a well-adapted drought crop, essentially since of the powerful water absorption due to its efficient root system (Belhassen, 1995). It has been found that both quantity and drought has a significant effect on growth and developments (Krizmanic *et al.,*

Table 1. Anova analysis of the mung bean affected by irrigation period and salicylic acid

SOV	df	Grain yield (Kg.ha^{-1})	Dry forage yield (Kg.ha^{-1})	Wet forage yield (Kg.ha^{-1})	Plant height (Cm)
R	2	30303.36	1391270.07	91117.44	1.36
Salicylic acid (S)	3	69573.07*	326833.42**	11155452.22**	4.24**
Irrigation Period (I)	2	87176.02*	541536.95**	4318567.02**	14.11**
S*I	6	40870.43^{ns}	47212.56**	44490275.69**	8.29**
Error	22	16127.90	1391270.07	63961.14	0.81
CV	-	30.92	16.96	5.62	4.09

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

2003; Iqbal *et al.,* 2005). Multiplicity of growth decrease by water stress depends on the growth stage of a plant, the severity of the water stress. Petcu *et al.* (2001) showed that seed yield of sunflower hybrids were affected by water stress with the low status treatment growth10-13% less than the control treatment. Igbal *et al.* (2005) reported a trend in growth reduction and decrease of yield components due to drought treatments. Razi and Asad, (1998) indicated that water deficit at flowering stage was observed to be a limiting factor for seed filling, so significant decrease of unfilled seeds were observed as a result of drought stress. Andria *et al.* (1995) reported that, the ability of sunflower to extract water from deeper soil layers as “when water stress during the early vegetative phase causes stimulation of deeper root system” and a tolerance of short periods of water deficit, are useful traits of sunflower for producing acceptable yields in dry land farming. On the other hand, some evidences have indicated that water stress deficit causes considerable decrease in the yield and oil content of sunflower (Stone *et al.,* 2001).

MATERIALS AND METHODS

The experiment was conducted at the zahak region in 2016. The field experiment was conducted with randomized complete block design with three replications. Treatments included salicylic acid at control (0), 25, 50 and 100 ppm, and irrigation period involves: 6 days once, 9 days once and 12 days once along with a control. Mixed soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical specification. Soil bit size repartition by pipette way and soil bulk density was specified by the core way. Soil reaction (pH) and Electrical Conductivity (EC) were specified at the same soil water pendency 1:1 (W:V) by pH-meter and electrical conductivity-bridge, respectively. Soil attributes of field were: pH 7.9, 1.12% organic matter 0.25% total nitrogen, 8.31 mg kg^{-1}

Table 2. Comparison of different traits affected by salicylic acid and drought stress

Treatments	Dry forage yield (Kg.ha^{-1})	Wet forage yield (Kg.ha^{-1})	Plant height (Cm)	Grain yield (Kg.ha^{-1})
Salicylic acid				
Control	937.4^{c}	2908.0^{d}	21.38^{c}	327.5^{b}
25 ppm	1091.1^{bc}	4625.0^{c}	21.61^{bc}	348.1^{b}
50 ppm	1837^{a}	5459.6^{a}	22.88^{a}	513.3^{a}
100 ppm	1258.2^{b}	4997.7^{b}	22.33^{ab}	453.4^{ab}
Irrigation period				
6 days once	1469.36^{a}	5190.3^{a}	23.16^{a}	508.08^{a}
9 days once	1211.20^{b}	4154.6^{b}	22.00^{b}	373.67^{b}
12 days once	1162.17^{b}	4147.8^{b}	21.00^{c}	350.08^{b}

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

Olsen Phosphorus, clay-loam texture (30% silt, 40% clay and 30% sand) and 1.41 $gr.cm^{-3}$ bulk density. Organic matter was determined by the method of Black (1965) and Page *et al.* (1982). Entire other agricultural practices were accomplished equally within the growth season. Weeds were manually eradicated whenever they were observed in the field. At maturity stage, plant height were determined based on five randomly selected plants from each sub-plot, then by harvesting the plants of central three rows of each plot. Plant Height is calculated by ruler from the soil surface to the tip of the tallest plant. Data collected were subjected to statistical analysis by using a computer program SAS (Mafakheri *et al.,* 2010). Data were analysis of variance (ANOVA), and means were compared using LSD test at P = 0.05.

RESULTS AND DISCUSSION

Grain yield

The maximum of grain yield was obtained on 50 ppm treated samples (Table 2). The minimum of grain yield of was obtained on control samples (Table 2). Analysis of variance showed that the effect of salicylic acid on grain yield was significant (Table 1). The maximum of grain yield was obtained in six days once treatment (Table 2). The minimum of grain yield was obtained on the control samples (Table 2). Analysis of variance showed that the effect of irrigation period on grain yield was significant (Table 1). About effects of exogenous application of SA, Lian *et al*., (2000) reported an improvement in grain yield of soybean under water stress when seeds were applied with SA. Drought stress reduces mungbean grain yield. However, drought stress that exists at the reproductive stage severely affects grain yield of mungbean more than its occurrence at other stages (Thomas *et al*., 2004).

Dry forage yield

The maximum of dry forage yield was obtained on 50 ppm treated samples (Table 2). The minimum of dry forage yield of was obtained on control samples (Table 2). Analysis of variance showed that the effect of salicylic acid on dry forage yield was significant (Table 1). The maximum of dry forage yield was obtained in six days once treatment (Table 2). The minimum of dry forage yield was obtained on the control (Table 2). Analysis of variance showed that the effect of irrigation period on dry forage yield was significant (Table 1). The present results agree with Slama *et al.,* (2006), Thomas *et al.,* (2004), Schuppler *et al.,* (1998), Ashraf and Ibram (2005) and who stated that shoot fresh and dry forage yield of two leguminous plants, *Phaseolus vulgaris* and *Sesbania aculeata,* decreased significantly due to drought stress.

Wet forage yield

The maximum of wet forage yield was obtained on 50 ppm treated samples (Table 2). The minimum of wet forage yield of was obtained on control samples (Table 2). Analysis of variance showed that the effect of salicylic acid on wet forage yield was significant (Table 1).

The maximum of wet forage yield was obtained in six days once treatment (Table 2). The minimum of wet forage yield was obtained on the control (Table 2). Analysis of variance showed that the effect of irrigation period on wet forage yield was significant (Table 1).

Comparable review of results were obtained by Haqqani and Pandey (1994) who showed that drought stress decreased yield, 1000 seed weight and pod number of mung bean but higher yield was obtained by manure application. Drought stress during pollination increased the frequency of kernel abortion in maize (*Zea mays*). Under drought stress, diminished grain set and wet forage yield in wheat and a decreased rate of endosperm cell division was associated with elevated levels (Ober *et al*., 1991).

Plant height

The maximum of plant height was obtained on 50 ppm treated samples (Table 2). The minimum of plant height of was obtained on control samples (Table

2). Analysis of variance showed that the effect of salicylic acid on plant height was significant (Table 1). The maximum of plant height was obtained in six days once treatment (Table 2). The minimum of plant height was obtained on the control (Table 2). Analysis of variance showed that the effect of irrigation period on plant height was significant (Table 1).

Water stress in soybean decrease plant height and the branch yield (Frederick *et al*., 2001). Decreased wheat height resulted from decrease sucrose synthase activity, while cessation of development resulted from inactivation of adenosine diphosphate-glucose-pyrophosphorylase in the water-stressed wheat (Ahmadi and Baker, 2001).

CONCLUSION

In this study, we determined that salicylic acid and irrigation period affected the grain yield, dry forage yield, plant height and wet forage yield. Furthermore, we demonstrated that exogenously applied SA increased yield and yield component..

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