The Andhra Agric. J 59(1): 106-109, 2012

Effect of Water Stress on Seed Germination and Seedling Growth in Greengram

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ABSTRACT

A laboratory experiment was conducted at Department of Plant Physiology,S.V.Agricultural college Tirupathi during *kharif* 2010-11to study the effect of water stress on seed germination and seedling growth in greengram genotypes .The results revealed that as the water stress increased from -0.3 M.Pa to -1.5 M.Pa ,the percentage of germination , root, shoot length and seedling vigor index was decreased in all the genotypes . Among the greengram genotypes tested ,MGG357 and MGG 360 withstand the water stress even up to -1.5 M.Pa followed by MGG347 ,MGG348 ,WGG2,LGG450 and LGG460.

Key words : Greengram, Seed germination, Seedling vigor index, Water stress

Seed germination and early seedling growth are considered important for crops establishment and yield of the crop (Gelmond ,1978) .Germination and seedling emergence are sensitive to water stress conditions and vary from species to species and from cultivars to cultivars (Sharma *et al* 2007).Among the growth stages early plant growth is important since the later development and crop productivity depend on effective germination and seedling emergence .Such phenomenon is more concerned to the successful cultivation of pulses and millets .The present study was therefore conducted to know the effect of water stress on seed germination and seedling growth of greengram genotypes .

MATERIAL AND METHODS

A laboratory experiment was conducted in Department of Plant Physiology ,S.V.Agricultural college Tirupathi with factorial randomized block design replicated thrice during *kharif* 2010-11.The treatments consists of 7 greengram genotypes (MGG 357,MGG 348,MGG 347,MGG 360,LGG 460,LGG 450,WGG 2) and 6 levels of water potentials (control, -.0.3 M.Pa ,-0.6 M.Pa ,-0.9M.Pa ,-1.2 M.Pa and -1.5 M.Pa water potential).Fifty seeds of uniform size from each genotypes were placed in the petridishes containing filter paper .The seeds were treated with polyethylene glycol solutions of -.0.3 M.Pa ,-0.6 M.Pa ,-0.9M.Pa ,-1.2 M.Pa and -1.5 M.Pa and water as control and petridishes were kept for germination under laboratory conditions .Germination counts were taken on 4th day after sowing .Twenty seedlings were randomly selected from each petridish on the 6th day after sowing for measuring root and shoot length .Seedling vigor index was calculated by multiplying seedling length with germination percentage .

RESULTS AND DISCUSSION

The greengram genotypes showed a significant difference in seed germination at different water potentials (Table 1). The interaction between genotypes and water potential was also significant. Among the genotypes tested, MGG 357 recorded maximum percentage of germination at all the osmotic potential compared to that with other genotypes. In all the genotypes as the water stress increased from -0.3 M.Pa to -1.5 M.Pa, the percentage of germination was decreased. This might be due to the decreasing of water potential, water imbibed by the seeds was decreased by osmotic effect hence result in decreased germination of the seeds. At -1.5 M.Pa , MGG 357 recorded maximum germination percentage of 50 followed by MGG 360(40%) ,MGG 347(25%) and MGG348(20%). The other genotypes was not germinated at -1.5M.Pa .There was a differences in genotypes for drought resistance in green gram .This shows that MGG 357 can withstand higher water stress showing it drought resistance nature .Decline in seed germination with the increase in moisture stress was also reported by Rao (1997) in Korra.

There was a significant differences between the genotypes and water potentials regarding root length of greengram (Table 1).As the water stress increased from -0.3 M.Pa to -1.5 M.Pa ,there was

Table 1. Seed germination and root length of greengram genotypes under water deficit conditions .

Genotypes	Germination (%)							Root length (Cm)						
	Water potential (M.Pa)							Water potential (M.Pa)						
	Control	-0.3	-0.6	-0.9	-1.2	-1.5	Mean	Control	-0.3	-0.6	-0.9	-1.2	-1.5	Mean
MGG 357	100	100	95.0	80.0	70.0	50.0	84.1	5.0	4.8	4.0	3.8	3.0	2.1	3.78
	(90.0)	(90)	(77.0)	(63.4)	(54.7)	(45.0)	(66.5)							
MGG 348	97.0	90.0	85.0	70.0	40.0	20.0	67.8	4.3	4.0	3.0	2.8	2.1	1.5	2.95
	(80.0)	(71.50	(67.2)	(54.7)	(39.2)	(26.5)	(54.9)							
MGG 347	100	95.0	80.0	75.0	50.0	25..0	71.6	4.5	4.1	3.3	3.1	2.5	1.6	3.18
	(90.0)	(77.0)	(63.4)	(60.0)	(45.0)	(30.0)	(57.8)							
MGG 360	100	100	90.0	78.0	65.0	40.0	80.5	4.8	4.4	3.8	3.5	2.7	1.8	3.50
	(90.0)	(90.0)	(71.5)	(62.0)	(53.7)	(39.0)	(63.7)							
LGG 460	90.0	80.0	75.0	55.0	15.0	-	63.0	3.9	2.9	2.0	1.5	1.0	-	2.26
	(71.5)	(63.4)	(60.0)	(47.8)	(22.7)		(52.5)							
LGG 450	92.0	82.0	78.0	60.0	20.0	-	66.4	4.0	3.0	2.2	2.0	1.2	-	2.48
	(73.5)	(64.9)	(62.0)	(50.7)	(26.5)		(54.3)							
WGG 2	95.0	85.0	83.0	65.0	30.0	-	71.6	4.1	3.8	2.7	2.5	1.5	-	2.92
	(77.0)	(67.2)	(65.6)	(53.7)	(33.2)		(57.8)							
Mean	96.28	90.2	83.7	69.0	41.4	33.7	-	4.3	3.8	3.0	2.74	2.0	1.0	-
	(78.7)	(71.5)	(66.1)	(56.1)	(39.8)	(35.0)								
C.D at 5% Genotypes(G)							4.51							0.30
Water potential(W)							5.15							0.50
GXW							9.50							0.80

Figures in parenthesis indicates arcsine transformed values

Table 2. Shoot length and seedling vigor index of greengram genotypes under water deficit conditions

Genotypes	Shoot length (Cm)							Seedling vigor index						
		Water potential (M.Pa)							Water potential (M.Pa)					
	Control	-0.3	-0.6	-0.9	-1.2	-1.5	Mean	Control	-0.3	-0.6	-0.9	-1.2	-1.5	Mean
MGG 357	8.8	8.5	8.0	7.5	7.0	5.0	7.7	1389	1330	1140	904	700	355	969
MGG 348	7.5	7.0	6.4	6.0	5.5	3.0	6.0	1144	990	799	616	304	90.0	657
MGG 347	8.0	7.5	7.0	6.5	6.0	3.5	6.6	1250	1102	824	720	450	127	745
MGG 360	8.5	8.0	7.5	7.0	6.8	4.5	7.3	1330	1240	1017	819	617	252	879
LGG 460	5.3	3.5	3.0	2.4	2.0	-	3.2	828	512	375	214	145	-	414
LGG 450	5.5	4.0	3.8	3.0	2.5	-	3.7	874	574	468	300	74	-	458
WGG 2	6.0	5.1	4.8	4.0	3.5	-	4.6	959	756	622	422	150	-	581
Mean	7.0	6.2	5.7	5.2	4.7	4.0		1110	929	749	570	348	206	
C.D at 5%														
Genotypes(G)							0.65							50
Water potential(W)							0.53							101
GXW							1.10							149

a simultaneous decreasing of root length in all greengram genotypes .The decreased root length might be due to the decreasing of water potential .Among the greengram genotypes ,MGG 357 recorded maximum root length at all water potential treatments compared to other genotypes .At -1.5 M.Pa ,MGG 357 recorded maximum 2.1 cm root length followed by MGG 360(1.8cm).Similar results were reported by Gupta *et al* (2000) in chickpea.

There was a significant differences between genotypes and water potential treatments regarding shoot length in green gram genotypes ($Table_2$) .As the water stress increased from -0.3 M.Pa to -1.5M.Pa there was a decrease in shoot length in all genotypes .Among the genotypes ,MGG357 recorded maximum shoot length at all water potentials compared to other genotypes . At -1.5 M.Pa, MGG357 recorded a shoot length of 5 cm followed by MGG 360 (4.5 cm) .This clearly indicates that MGG 357 having drought resistance nature. Similar results were reported by Rao (1997) in Korra.

Seedling vigor index(SVI) is the most important parameter to judge the drought resistance of the genotype .There was a significant difference between genotypes and water stress treatments regarding SVI of greengram genotypes. As the water stress increased from -0.3 to -1.5 M.Pa, there was a significant decrease in SVI of genotypes .This might be due to decreasing of germination, root length and shoot length under water stress conditions. The decreasing of seedling growth in response to increasing of moisture stress in field and laboratory conditions were also reported by Rao (1997) in Korra and Gupta *et al* (2000) in chickpea . Among the genotypes, MGG 357 recorded maximum SVI at all water stress treatments compared to other genotypes .At -1.5 M.Pa ,MGG357 recorded SVI of 969 followed by MGG 360 (879) .The present preliminary study revealed that MGG 357 and MGG 360 genotypes of greengram can withstand moisture stress conditions and their performance at reduced levels of moisture stress requires a detailed field study .

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(Received on 04.08.2011 and revised on 06.09.2011)