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Influence of seed treatment with plant extracts on physiological parameters of amaranth, *Amaranthus tricolor* L

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ABSTRACT

Though several treatments have been tested to envisage amaranthus seed emergence, seed treatment is one of the important technologies to find out the significant interaction among the test used, the cultivar and the environmental conditions through seed emergence. Hence a laboratory experiment was conducted to calculate the emergence of amaranthus seeds of cultivar CO-3 in 2013 at the Seed Technology Laboratory, Vanavarayar Institute of Agriculture, Pollachi, TN. The study was done in a completely randomized design consisting of six green leaf extracts (*Cassia fistula, C auriculata, Annona squamosa, Dalbergia oliveri, Morinda tinctoria and Jatropha curcas*) @ 5 per cent in the form of seed treatment and control using distilled water. The results indicated that there were significant differences in seed attributes due to the application of leaf extracts. Seed quality parameters were found to be high in seeds treated with *M tinctoria*.

Key words: Amaranthus; seed quality attributes; leaf extract

INTRODUCTION

Amaranth belongs to the C_4 plant group which is distinguished by high photosynthesis productivity. Belonging to family Amaranthaceae it has three times more calcium and vitamin B than spinach leaves as well as twenty times more iron than lettuce (Bradtke 2013). Amaranth has also been regarded as relatively drought tolerant thus suggesting that reasonable yield can be realized with limited irrigation. A traditional method of discovering and developing new tree based bio-formulation with the help of indigenous knowledge is easier and less expensive. The use of natural plant extracts as crop health tonics are attractive due to the increasing need for eco-friendly, safe and selective bio-formulations for total healthcare in crop production. Rapid and uniform field emergence is the essential prerequisite to increase the yield, quality and ultimately the profits in annual crops. Pre-sowing seed treatment is one such technological highlight focused to the above goals.

Pre-sowing seed invigouration treatments are numbered by many researchers (Sundaralingam et al 2001)

and all are claimed to have invigorative effect in field for enhancing the yield of crop to a tune of 10-15 per cent (Vijayakumar 1996). Some of the widely pronounced pre-sowing seed management techniques are seed fortification with growth regulators (Nandhakumar 2010), botanicals (Sakthivel 2011), pelleting (Rajalakshmi 2013), osmotic priming and seed infusion (Khan et al 2003). Hence an attempt was made to study the performance of plant green leaf extracts on physiological parameters of amaranthus.

MATERIAL and METHODS

The present investigation was carried out to test the affect of 6 plant leaf extracts (*Cassia fistula, C auriculata, Annona squamosa, Dalbergia oliveri, Morinda tinctoria and Jatropha curcas*) on amaranth seeds to see the effect on physiological parameters viz germination per cent, shoot length (cm), root length (cm) and vigour index under laboratory. Seeds were allowed to germinate in Petri dish. Petri dishes were sterilized using ethanol (70%) and then washed with distilled water. The surface sterilized (70% ethanol) 20 seeds were placed in each Petri dish to germinate. Distilled water was used for maintaining the control. The leaf extracts for each tree species were prepared by grinding fresh leaves and distilled water at 1:1 proportion and the extract was filtered which served as stock solution. From the stock solution five per cent solution was made for soaking of seeds for 12 hours. The seeds were subjected to germination test with three replications. The germinability was recorded on the 15th day after sowing (DAS) and number of seeds germinated was expressed as per cent. On 7th DAS seedlings from each replication were carefully removed at random. Length of shoot was measured from the collar region to the tip of the longest leaf. Root length of the seedlings was measured from the base of the stem to the tip of the longest root. The vigour index of the seedlings was calculated using the following formula proposed by Abdul-Baki and Anderson (1973). The data on different parameters were compiled and subjected to statistical analysis.

RESULTS and DISCUSSION

Germination (%): The highest germination (90%) was found in *Cassia fistula, Dalbergia oliveri* and *Jatropha curcas* which was on par with one another followed by control. Interestingly the remaining treatments *C auriculata, Annona squamosa and Morinda tinctoria* recorded lowest germination percentage when compared to control. It is presumed that these botanicals contain some of the micronutrients which are conducive for seed invigouration as reported by Manimekalai (2006). But Lowell (2005) reported that the leaf extract contains saponin like substance which acts as a precursor of GA3 and invigourated the seed at a particular concentration.

Shoot length (cm): Highest shoot length of 3.9 cm was recorded in *C auriculata* which was on par with *D oliveri* and *J curcas*. The minimum shoot length was noted in *C fistula* of 2.6 cm in amaranthus. The increased shoot length due to seed treatment with plant leaf extracts may be attributed to cell wall extension and increased metabolic activities at low water potential as in matripriming (Afzal et al 2002). Kavitha et al (2005) stated that the leaf extracts of *Vitex negundo* caused significant changes in the germination percentage. As compared to the control the aqueous leaf extracts of *V negundo* at 5 per cent concentration exhibited promotory effect on seed germination and seedling growth in both green gram and black gram.

Root length (cm): The treatments did not differ significantly for root length in amaranthus. However the data indicate that the *J curcas* recorded highest shoot length of 5.0 cm as compared to all other treatments. The other plant extracts were on par with each other for root length. The presence of phenols in the leaf extract of *J curcas* would have promoted the root length. Similar observations were recorded by Nandhakumar (2010) in maize and Suguna (2012) in barnyard millet. The control recorded the lowest root length in all the vegetables. This might be due to low availability of nutrients in the water. Iftikhar (2009) observed increased emergence and vigorous plant development when seeds primed with Moringa leaf extract due to the presence of calcium, potassium, ascorbic acid and cytokinin in it.

Vigour index: *J curcas* recorded significantly higher value for vigour index followed by *C auriculata*. The *C auriculata, D oliveri* and *C fistula* were on par with respect to vigour index. The lowest vigour index of 447.0 and 512.0 was noticed in control and *M tinctoria.* The range of vigour index was between 756.00 and 447.0.

Correlation and regression co-efficient analysis: Simple regression coefficient analysis among different seed attributes is shown in Fig 1 to Fig 3 while correlation co-efficients are shown in Table 2. A positive correlation was observed between germination percentage, root length and vigour index whereas the association between germination percentage and shoot length was found to be negative. The only significant and positive relationship was between root length with vigour index in amaranthus (0.93).

The relationship between shoot length and root length was found to be very weak since it recorded low 'r' values. It was found that the association between shoot length with vigour index was positive. Khatun et al (2009) also found positive and significant correlation of germination percentage with root plus shoot length and vigour and root plus shoot length with vigour.

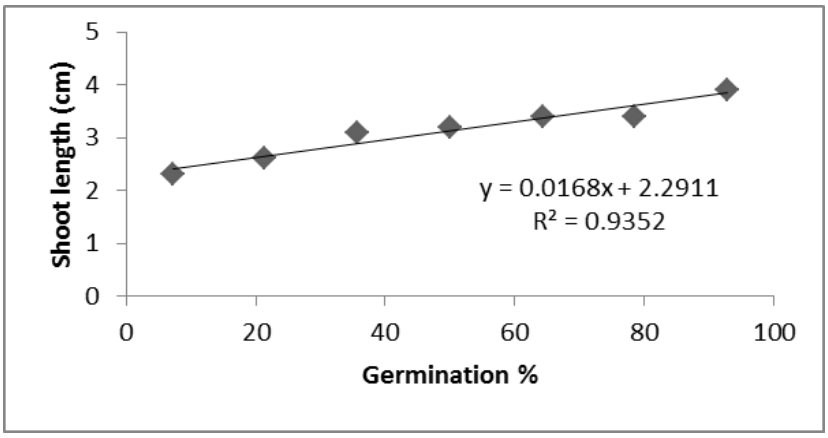

Fig 1. Relationship between shoot length (cm) and germination (%) of amaranthus

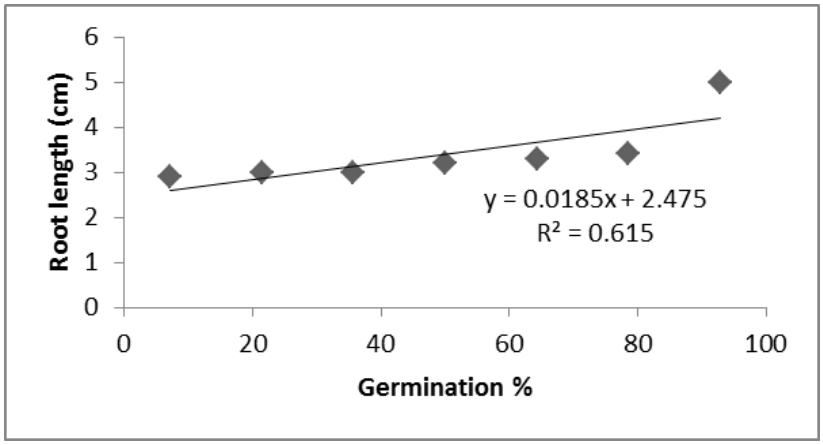

Fig 2. Relationship between root length (cm) and germination (%) of amaranthus

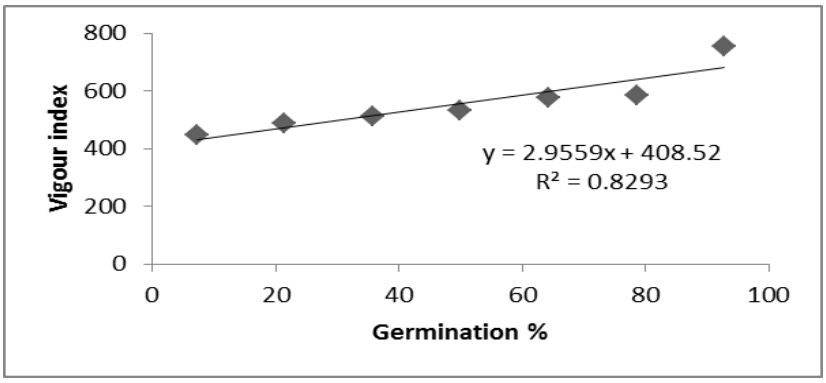

Fig 3. Relationship between vigour index and germination (%) of amaranthus

Table 1. Response of amaranthus to seed treatment with plant leaf extract

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Vigour index
Control	86*	2.3	2.9	447.22
Cassia fistula	90*	2.6	3.3	531.00
C auriculata	80	3.9*	3.4	584.00*
Annona squamosa	80	3.1	3.0	488.00
Dalbergia oliveri	90*	3.4*	3.0	576.00*
Morinda tinctoria	80	3.2	3.2	512.00
Jatropha curcas	90*	3.4*	5.0*	756.00*
Mean	85.14	3.13	3.40	556.32
SD	4.64	0.49	0.67	92.74
SEd	0.66	0.07	0.10	13.25
$CD_{0.05}$	1.23	0.17	0.26	24.01

*Significant at 5% level

Table 2. Correlation matrix among different parameters of amaranthus

Character	Pearson's correlation co-efficient (r)		
	Shoot length (cm)	Root length (cm)	Vigour index
Germination (%)	-0.30	0.37	0.43
Shoot length (cm)		0.34	0.57
Root length (cm)			0.93*

*Significant at 5% level

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