RESEARCH ARTICLE

IMPACT OF SEED INVIGORATION TREATMENTS ON SEED YIELD AND YIELD PARAMETERS OF AGED SEED OF GREENGRAM CULTIVAR LGG-460

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Abstract: In order to evaluate the effect of seed invigoration treatments on seed yield and yield parameters, the study was conducted at Agricultural Research Station (ARS), Jangamaheswarapuram, Guntur. The aged revalidated seed of greengram cv. LGG-460 was taken from each treatment and was given invigoration treatments. The invigorated seed along with the control (aged seed & fresh seed) were sown in the field. The observations were recorded on days to 50% flowering, no. of pods per plant, no. of seeds per plant, seed yield per plant, harvest index, shelling percentage and 100 seed weight.The results indicate that all invigoration treatments exhibited significant increase over the aged seed. Among the treatments bleaching powder @ 2g/kg of seed, hydroprimed and dry dressed with thiram @ 0.25 % and red chilli powder @ 1g/kg of seed improved the yield and yield parameters of aged seed of greeengram and can be recommended for improving the yield of greengram.

Keywords: Greengram, Invigoration, Hydropriming

INTRODUCTION

Greengram [*Vigna radiata* (L.) Wilczek] is an ancient, well known leguminous crop and third most popular pulse crop cultivated throughout India. It is an excellent source of high quality protein (25 %) and amino acid like lysine (4600 mg/g N) and tryptophan (60 mg/g N) and is consumed as whole grain or dal (Dhakal *et al*., 2016).

Any achievement in the crop improvement can be propagated and established in field only through seed. Hence the production of high quality seed is necessary and important to agricultural industry (Sasthri and Kalaivani, 2005). Quality seed is the key for successful agriculture, which demands that each and every seed should be readily germinable and produce a vigorous seedling ensuring higher yield (Ananthi *et al*., 2013).

Seed are usually produced in excess as a precaution against germination failure and also against failure of crop in the subsequent crop growth period. The demand for seed fluctuates very often and there may be a large surplus of seed which need to be stored for the subsequent 2-3 sowing seasons. Such left over seed when stored pass through the hot and humid monsoon periods which affect the viability and vigour of seed.Though, the seed many a time meets germination standard, the biological entity may not be capable of protecting and nourishing the young seedling in the field due to ageing/deterioration in storage and the performance of validated seed may not be as satisfactory as that of fresh seed. Therefore, maintenance of good germinability and vigour of carry-over seed is of great importance to seed producer, supplier and the farmer. Seed enhancement, which aims to improve seed germination and seedling growth, encompasses many techniques performed on seed after harvest and before sowing (Copeland and Mc Donald, 1995 and Taylor *et al*., 1998). Seed invigoration is a technique of seed enhancement, it implies an improvement in seed vigour by any post harvest treatment resulting in improved germination, better field emergence and longer storability than the corresponding untreated seed, which also helps seedlings to grow in biotic or abiotic stress conditions (Ashraf and Foolad, 2005; Khan *et al.*, 2009a and 2009b) and act as an efficient carrier of nutrient and fungicide in early stage of crop growth. Such seed treatments result in synchronized emergence and uniform stand establishment leading to improved yield. Hence, the present investigation was taken up to study the impact of invigoration treatments on yield and yield parameters of greengram cv. LGG-460.

MATERIALS AND METHODS

The present investigation was carried out at Department of Seed Science and Technology, Advanced Post Graduate Centre, Lam, Guntur during 2016-17. The greengram seed of variety, LGG-460 (*kharif*, 2015 harvested seed and *rabi*, 2015-16 harvested seed) was collected and a preliminary experiment was conducted to standardize the duration of invigoration treatments and 8 hours hydration was found to be ideal for greengram variety LGG-460. The seed were invigorated by soaking one kg of seed in 400 ml of respective solution. After hydration the seed were dried back to original seed moisture content under shade. The hydration treatments are $CaCl_2$ (2%), hydropriming, moringa leaf extract (5%), KNO3 (1.5%), hydropriming followed by dry dressing with thiram (0.25%). Moringa leaf extract (MLE) was prepared by collecting young and disease free leaves from moringa tree. These leaves were washed and then

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frozen for two days in refrigerator at 4^0 C. Leaves were grounded in a manual juicer to extract the leaf juice. The juice was collected and filtered by passing through a muslin cloth and 5 % solution was prepared (Iqbal *et al*., 2014).Seed were also invigorated by dry dressing with bleaching powder (2g/kg of seed) and red chilli powder (1g/kg of seed). The invigorated seed along with the untreated seed (control) (*kharif*, 2015 harvested aged seed and *rabi*, 2015-16 harvested fresh seed)were sown in the field. The observations were recorded on days to 50% flowering, no. of pods per plant, no. of seeds per plant, seed yield per plant, harvest index, shelling percentage and 100 seed weight.

Statistical analysis

The data recorded were analyzed statistically by adopting Randomized Block Design as described by Panse and Sukhatma (1978) and the critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical signifinance (*). If F test is non-significant, it was indicated as NS.

RESULTS AND DISCUSSION

The data on effect of invigoration treatments on days to 50 % flowering was presented in Table 1. The days to 50 % flowering ranged from 38 to 41 DAS in different treatments. But were not statistically significant. Rao (1993) also reported that days to 50 per cent flowering did not show any significant variation due to seed invigoration treatments in sorghum. Through invigoration treatment effect was not observed in greengram in respect of days to 50 % flowering, significant decrease was reported in wheat (Bray, 1995), rice (Lee *et al*., 1998 and Lee and Kim, 2000), soybean (Arif, 2005), sunflower (Narayanareddy and Biradarpatil, 2012) and sorghum (Biradarpatil *et al*., 2009).

The data on number of pods per plant was presented in Table 1. Invigorating the aged seed increased the number of pods per plant and the increase was statistically significant in all the treatments expect in hydropriming and KNO_3 treatment and were on par with fresh seed. Among all the aged invigoration treatments, hydropriming recorded the less number of pods per plant (21.9) this is in contrary to the report of Punjabi *et al.* (1982) who observed more number of pods per plant and pod yield with hydroprimed seed in blackgram. All the aged invigorated treatments were on par with fresh seed. Treating of aged seed with bleaching powder @ 2g/kg of seed recorded highest number of pods per plant (24.6) followed by red chilli powder (24.5). Increase in number of pods per plant was reported in blackgram by invigorating with bleaching powder @ 2g/kg of seed (Layek *et al*., 2012) and by red chilli powder treatment in chickpea (Layek *et al*., 2006). Saha *et al.* (2006) reported that seed invigoration with moisture equilibration-drying, bleaching powder and iodine treatments improved number of pods per plant in chickpea.

The data recorded on number of seed per plant was present in Table 1 When the aged seed was given with different invigoration treatments there was significant increase in number of seed per plant and the increase was statistically superior in all the treatments except in moringa leaf extract and KNO_3 treatments. All the invigoration treatments were on par with fresh seed except moringa leaf extract and KNO_3 treatment. Among the invigoration treatments, treating of aged seed with bleaching powder @ 2g/kg of seed recorded highest number of seed per plant (251.9) followed by red chilli powder (243.2) and hydroprimed by dry dressed with thiram (238.8). Such increase in number of seed per plant with bleaching powder and red chilli powder treatment was earlier reported by Layek *et al*. (2012) in blackgram, Saha *et al*. (2006) and Layek*et al*. (2006) in chickpea and Saha and Mandal, (2015) in sunflower.

Significant difference were noticed between aged seed and fresh seed with respect to seed yield per plant. Seed yield recorded by fresh seed (6.9 g) was statistically superior to aged seed (4.7 g). Superior performance of high vigor seed over low vigor seed was reported by Shankaraiah (2010) in sorghum. The data on seed yield per plant was given in Table 1. All the invigoration treatments, expect $CaCl_2$ and moringa leaf extract, recorded statistically superior values over the aged seed. Dharamlingam and Basu (1993) reported that invigorated greengram seed produced healthy plants with higher yield compared to control seed. Highest seed yield per plant was recorded by bleaching powder treatment (7.5 g) followed by hydrated and thiram dressed seed (7.1g) and it was numerically superior to the fresh seed. Invigorated seed was on par with fresh harvested seed in respect of seed yield per plant expect moringa leaf extract and $CaCl_2$ treated seed. It is clear that treating of aged seed with bleaching powder @ 2g/kg of seed increased seed yield per plant over other treatments. These results were in accordance with the Layek *et al.* (2006) in chickpea and Guha *et al.* (2012) in okra. Swati *et al*. (2010) reported that seed invigorated with vitavax and hydration (2 hours) followed by dry dressing with thiram recorded improved seed yield per plant in soybean.

Harvest index recorded by fresh seed (36.8 %) was statistically superior to the aged seed (30.2 %). (Table 2). Invigoration treatments significantly improved the harvest index and was statistically significant over aged seed. Among all the invigoration treatments, the aged seed hydroprimed and dry dressed with thiram (38.6 %) recorded the highest. However Swati *et al*. (2010) reported that vitavax and hydration (2 hours) followed by dry dressing with thiram increased the harvest index in soybean. All invigoration treatments were on par with fresh seed except hydropriming treatment.

While Soleimanzadeh (2013) recorded maximum harvest index in maize by hydropriming.

The data related to the seed yield per square meter was presented in Table 2. Seed yield per square meter recorded by fresh seed (142.1 g) was statistically higher than the seed yield per square meter recorded by aged seed (111.9 g). All the invigoration treatments except $CaCl_2$, hydration and moringa leaf extract treatments, were significantly superior to the aged seed. Treating of aged seed with bleaching powder @ 2g/kg of seed recorded the highest seed yield per square meter (148.2 g). The results are in harmony with those obtainted by Layek *et al*. (2012) in urdbean, Saha *et al*. (2006) in chickpea, Mandal *et al*. (1999) in wheat and Saha and Mandal (2015) in sunflower. Vidyadhar and Singh (2000) observed that halogenation of mustard and maize seed with chlorine (common bleaching powder) during storage resulting in stabilization of membrane lipid double bonds (Rudrapal and Basu, 1981) ensuring higher seed vigour and enhanced yield (Farooq *et al*., 2008). Besides these possibilities, halogens like iodine also act as a free radical controlling agent (Pryor and Lasswell, 1975). Rao *et al*. (2014) reported increased in seed yield of greengram by invigoration of seed with hydration (2 hours) followed dry dressing with thiram @ 0.25 %. There were reports of germination and vigour promotion and ultimately the yield in groundnut by hydropriming (Narayanaswamy and Channarayappa, 1996 and Singh *et al*., 2002) and thiram seed dressing (Snehal *et al*., 2010 and Kumar and Sachan, 2015). Such improvement in germination and vigour was also observed in number of crops (ISTA, 1999; Maguire, 1962; Mitra and Basu, 1979; Ram *et al*., 2002; Subbaraman and Selvara, 1989 and Biradapatil *et al*., 2009).

Data related to shelling percentage was presented in Table 2. Aged seed (65.3) was statistically inferior to the fresh seed (75.2 %). Invigoration treatments significantly improved the shelling percentage and was statistically superior to the aged seed. Among all invigoration treatments hydroprimed and dry dressed with thiram recorded the highest shelling percentage (76.4 %) and hydration treatment (74.2 %) and were on par with fresh seed. While $CaCl_2$, moringa leaf extract, KNO_3 and red chilli powder invigorated seed were inferior to the fresh seed.

Test weight recorded in greengram cv. LGG-460 as influenced by the invigoration treatments was presented in Table 2. Significant difference was observed between fresh seed and aged seed with regards to 100 seed weight and fresh seed (2.90 g) was statistically superior to aged seed (2.63 g). 1000-grain weight is an important yield parameter and has influence on seed germination, seed vigor level, seedling establishment and yield (Hussian *et al*., 2014). Invigoration treatment given to the aged seed improved the 100 seed weight. The aged seed treated with bleaching powder @ 2g/kg of seed recorded the highest value (3.04g) followed by hydropriming and dry dressing with thiram (2.99g) and red chilli powder @ 1g/kg of seed (2.87g). All invigoration treatments were on par with fresh seed except hydropriming treatment. Contrary to this, hydropriming of soybean seed (Singh and Dadlani, 1999) and wheat (Mandal *et al*., 1999) seed ensured significantly higher 100 seed weight. From above investigation it is clear that bleaching powder @ 2g/kg of seed treatment increased the test weight significantly. These results are similar to the findings of Layek *et al*. (2012) in blackgram, Saha *et al*. (2006) and Layek *et al*. (2006) in chickpea, De *et al*. (2003) in wheat, Saha and Mandal (2015) in sunflower and Guha *et al*. (2012) in okra. Swati *et al*. (2010) stated that soybean seed invigorated with vitavax and hydration (2 hours) followed by dry dressing with thiram treatments were more effective in improving the 100 seed weight and yield. Halogen slurry treatment recorded higher 100 seed weight in sesamum, sunflower and groundnut (Sathiya *et al*., 2011).

Table 1. Effect of seed invigoration treatments on days to 50 % flowering per m^2, number of pods per plant, number of seed per plant and seed yield per plant (g) of greengram cv. LGG-460.

Treatments	Days to 50 % flowering	No.of pods/plant	No.of seed/plant	Seed yield per plant (g)
T_1 - Control – I; Aged seed (*Kharif* , 2015 harvested seed)	41.0	19.5	174.7	4.7
T_2 - Treating aged seed with $CaCl_2$ (2%)	40.0	23.5	221.6	5.6
T_3 - Hydropriming of aged seed	41.0	21.9	235.7	6.4
T_4 - Treating aged seed with moringa leaf extract (5%)	40.0	22.9	201.3	5.3
T_5 - Treating aged seed with KNO_3 (1.5%)	40.0	22.1	202.7	6.5
T_6- Hydropriming followed by dry dressing with thiram (0.25%)	39.0	24	238.8	7.1
T_7 - Treating aged seed with bleaching powder (2g/kg of seed)	38.0	24.6	251.9	7.5
T_8 - Treating aged seed with red chilli powder (1g/kg of seed)	39.0	24.5	243.2	6.4
T_9 - Control - II; Fresh seed (*Rabi*, 2015-16 harvested seed)	39.0	23.6	236.2	6.9
Mean	40.0	23.0	221.2	6.3
CD (5%)	NS	2.9	32.9	1.0

SEm±	0.9	1.0	10.9	0.3
SE(d)	1.2	1.4	15.4	0.5
CV (%)	3.7	7.3	8.4	9.1

Table 2. Effect of seed invigoration treatments on Seed yield (g/m^2) 100 seed weight (g), shelling (%) and harvest index(%) of greengram cv.LGG-460.

Treatments	Seed yield (g/m^2)	100 Seed weight (g)	Shelling (%)	Harvest index (%)
T_1 - Control – I; Aged seed (*Kharif*, 2015 harvested seed)	111.9	2.63	65.3	30.2
T_2 - Treating aged seed with $CaCl_2$ (2%)	129.2	2.75	69.7	33.3
T_3 - Hydropriming of aged seed	122.3	2.64	74.2	29.7
T_4 - Treating aged seed with moringa leaf extract (5%)	117.2	2.69	67.6	33.0
T_5 - Treating aged seed with KNO_3 (1.5%)	132.1	2.70	73.6	32.8
T_6 - Hydropriming followed by dry dressing with thiram (0.25%)	144.2	2.99	76.4	38.6
T_7 - Treating aged seed with bleaching powder (2g/kg of seed)	148.2	3.04	75.2	35.5
T_8 - Treating aged seed with red chilli powder (1g/kg of seed)	142.1	2.87	71.0	33.9
T_9 - Control - II; Fresh seed (*Rabi*, 2015-16 harvested seed)	136.8	2.90	75.2	36.8
Mean	131.6	2.80	72.0	33.8
CD (5%)	18.8	0.23	1.3	5.4
SEm±	6.2	0.08	0.4	1.8
SE(d)	8.8	0.11	0.6	2.5
CV (%)	8.2	4.79	8.4	9.1

CONCLUSION

From the present investigation, it can be concluded that invigoration of aged seed with bleaching powder @ 2g/kg of seed, hydroprimed and dry dressed with thiram @ 0.25 % and red chilli powder @ 1g/kg of seed improved the seed standards ultimately yield and yield parameters of aged seed of greeengram cv. LGG-460 moreover it is cost effective and can be easily adopted by the farmers.

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