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Influence of seed hardening and integrated seed treatment on seed yield and quality in green gram

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Abstract

Field experiments were carried out during 2010 and 2011, to evaluate the seed yield and quality performance of seed management techniques. The seeds of green gram cv. CO 6 were given hardening (hardening with $MnSO_4$ 100 ppm) and integrated seed treatment (designer seed) viz., hardening with $MnSO_4$ 100 ppm and hardening with $MgSO_4$ 100 ppm + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg and sown along with control seeds. The results revealed that, integrated seed treatment (designer seed) recorded higher field emergence, pod set (%), pod yield / ha, seed number / pod and seed yield / ha compared to $MnSO_4$ hardening and control. The seed yield / ha in the best treatment was 620 kg ha^{-1} , which was 6.0 per cent increase over the control and 4.2 per cent increase over $MnSO_4$ hardening.

Keywords: Green gram seeds, $MnSO_4$, Polymer, Carbendazim, Imidacloprid

Introduction

India is the largest producer and consumer of pulses in the world accounting area of 81 m ha and contributed 73.2 mt with productivity of 904 kg/ha. Nearly 7 per cent of the pulse area is occupied by green gram, which is the third most important pulse crop of India in terms of area cultivated and production next to chickpea and pigeon pea. In India, the production of pulses is around 18.30 million tonnes from an area of 28.20 million hectares. Area under green gram in India is 3.0 million hectares with an annual production of 1.5 million tonnes. In Tamil Nadu, the area under green gram is 2.3 million hectares with an annual production of 180.7 tonnes (<http://indiastat.com>). Although the production of pulses has increased, its availability has declined substantially. It implies that increase in production has not in pace with the growing population.

In Tamil Nadu, the low productivity of green gram is due to the cultivation of this crop in marginal and rainfed with poor management practices. The main constraint in raising the productivity levels of pulses in drylands are the inadequacy of soil moisture and poor fertility status of the soil. At present several seed enhancement techniques are available for quality upgradation. It has two goals; one is related to seed designing and other to seed functioning. Seed designing can be achieved by the seed management techniques viz., fortification, hardening, coating and pelleting. Various pre-sowing physiological and chemical seed treatment methods are available to increase the productivity. But, such scientific seed treatment methods are not adoptable to the farmers, mainly because of non-availability of chemicals and also the high cost. Application of nutrients to the dry land is a problematic one. By giving the nutrients to the seed it as pre-sowing treatment, viability and vigour of the seed could be improved and the productivity can be enhanced (Vijaya, 1996) [16]. Keeping these in view, the present study was made in green gram to determine the influence of seed hardening and integrated seed management practices on seedling establishment, growth performance, seed yield and quality productivity of green gram cv. CO 6

Materials and methods

Genetically pure, freshly harvested breeder seeds of green gram (*Vigna radiata* L. Wilczek) cv. CO 6 obtained from Agricultural Research Station, Bhavani sagar served as the base material for the study. The seeds were first preconditioned by keeping the seeds in between two layers of moist gunny bag for one hour. Then, the preconditioned seeds were soaked for three hours in 100 ppm $MnSO_4$ solution at 1/3 volume of seeds and air dried in shade to their original moisture content. Then the hardened seed with Polymer 3ml/kg + Carbendazim

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2g/kg + Imidacloprid 1ml/kg was added for integrated seed treatment. Field experiments were carried out at field No.12 & 25 of Pungar block of Agricultural Research Station, Bhavanisagar during 2010-2011. A trial was laid out with the above three treatments adopting randomized block design with seven replications under irrigated condition. The plot size was 4x 5 m² and the plant spacing was maintained at 45 x 15 cm, the recommended package of practices was followed uniformly for all the treatments. At field level, the following observations on growth, yield attributing characters and resultant seed quality parameters were taken.

Field emergence (%)

Seeds (4x100) were taken at random from each treatment and individually sown in raised beds of 3x3 m @ single seed per hill in four different lines under field conditions and were irrigated immediately after sowing and life irrigation was given on third day after sowing. The beds were watered periodically to maintain sufficient soil moisture and ten days after sowing the seedlings emerged with proper shoot and root were counted and the mean expressed as field emergence adopting the following formula and was reported in percentage.

$$\text{Field emergence (\%)} = \frac{\text{Normal seedlings produced}}{\text{Number of seeds sown}} \times 100$$

Number of flowers per plant

Total number of flowers produced per plant were counted in each of the treatment and replication and the mean expressed as number of flowers per plant in whole number.

Number of pods per plant

The number of mature pods per plant were actually counted in each of the treatment and replication and the mean pods per plant was arrived and expressed as whole number.

Pod set (%)

Pod setting percentage in each of the inflorescences or (branches) was calculated adopting the following formula and the mean expressed as percentage

$$\text{Pod set (\%)} = \frac{\text{Number of pods retained}}{\text{Number of flowers produced}} \times 100$$

Number of seeds per pod

Ten number of pods from each replication and treatment were split opened longitudinally and the number of seed in each pod from replication and treatment were counted. Mean number of seeds per pod was reported in whole number.

Pod yieldplant⁻¹ (g)

Pods produced in each of the plant were harvested as three pickings in five tagged plants replication wise and treatment wise when they mature and were dried, cleaned and weighed individually and the cumulative yield of all pickings was reported as pod yield per plant in gram.

Pod yieldha⁻¹ (kg)

Pods harvested in three pickings from each replication and treatment were dried, cleaned and weighed individually and the total weight of pods including five tagged plants in each replication and treatment were weighed and the cumulative

yield of all pickings was reported as pod yield plot⁻¹ in kilogram. Pod yield plot⁻¹ obtained was computed to pod yield per hectare and the mean reported in kilogram.

Seed yieldplant⁻¹ (g)

Pods harvested as three pickings were dried, cleaned replication wise and treatment wise and the seeds were extracted manually by pliable sticks, weighed and the cumulative yield of all pickings was expressed as seed yield plant⁻¹ in gram.

Seed yieldha⁻¹ (kg)

From each plot, pods harvested as three pickings were dried and cleaned and weighed individually and seeds were extracted manually by pliable sticks. The extracted seeds were pre-cleaned, processed and weighed and the cumulative yield of all pickings were expressed as seed yield plot⁻¹ in kilogram. Seed yield plot⁻¹ obtained was computed to seed yield per hectare and the mean reported as seed yield per hectare in kilogram.

Resultant seed characteristics

After harvest, the resultant seeds were pooled treatment wise and replication wise and with randomly selected sample the following observations were recorded.

100 seed weight (g)

Extracted seeds were dried to 8.0 per cent moisture content and seeds were counted in eight replicates of hundred seeds and weighed using an electronic balance, the mean expressed as 100 seed weight in gram.

Germination (%)

Germination test, in quadruplicate of 100 seeds, each with four sub replicates of 25 seeds were carried out in roll towel in a germination room maintained at temperature of 25 ± 1° C and RH of 96 ± 2% with diffused light. Final count based on normal seedlings was recorded on seventh day and the mean recorded as germination in percentage.

Root length (cm)

After the germination period of seven days, ten normal seedlings were selected at random in each of the replication, and were measured for root length, from the collar region to the tip of primary root using measuring scale. The mean expressed as root length in centimetre.

Shoot length (cm)

Seedlings used for measuring root length were also used for measuring shoot length. The length between the collar region to tip of the primary leaf (Plumule) was measured and the mean expressed as shoot length in centimetre.

Drymatter content (mg/ 10 seedlings)

Seedlings used for growth measurement were dried in an hot air oven maintained at 85±2°C for 24 h and cooled in a desiccator for 30 min. and weighed in an electronic balance and the mean expressed as drymatter production per 10 seedlings in milligram.

Vigour index

Vigour index (VI) was calculated by using the formula suggested by Abdul-Baki and Anderson (1973) ^[1] and the mean expressed in whole number.

VI = Germination (%) x [root length (cm) + shoot length (cm)].

Statistical Analysis

The data obtained from different experiments were analysed for 'F' test of significance following the methods described by Panse and Sukhatme (1985) [10]. Wherever necessary and the per cent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical significance (*). If F test is non-significant, it was indicated as NS.

Results and discussion

In the present study, the field emergence obtained with designer seed was six per cent higher than control and five per cent higher than hardened seed. The improvement in field emergence could be attributed to activation of cells, which resulted in the enhancement of mitochondrial activity leading to the formation of more high energy compounds and vital biomolecules, which are made available during the early phase of germination (Dharmalingam *et al.*, 1988) [3]. The fortified seeds triggered germination events that were halted

on drying back the seed to its original moisture content and when the seeds are sown, germination event begins from the point where it stopped previously (Heydecker and coolbear, 1977) [18], due to this consequences early emergence and establishment of seedling were achieved (Farahani *et al.*, 2011) [4]. Hydrophilic polymers enhanced the water uptake of the seeds (Schneider and Renault, 1997) [11].

The pod set per cent (78.50), number of pods / plant (46.16), pod yield / plant (15.75 g), pod yield / ha (1034 kg), number of seeds / pod (10.51), seed yield / plant (8.68 g) and seed yield / ha (620 kg), which were respectively 24.7, 6.08, 18.0, 5.5, 31.4, 5.8 and 6.0 per cent higher than the control seeds (Table 1). The yield increase obtained in the present study might be due to the combined effect of hardening, coating and pelleting that had enhanced the root-shoot ratio and nutrient uptake and had improved the yield attributing characters. This could be attributed to the fact that the MnSO₄ present in both these treatments, is the constituent of several dehydrogenase enzymes and also an activator of other enzymes. The increased pod yield also due to unanborted reproductive structures that could have resulted due to higher photosynthetic activity.

Table 1: Effect of hardening and designer seed on growth and yield characteristics of green gram cv. CO 6 under irrigated conditions

Parameters	Control	Hardened seed	Designer seed	SEd	CD (P=0.05)
Field emergence (%)	87	88	93	0.28	0.62
Pod set (%)	74.00	76.66	78.50	0.21	0.44
No. of pods/ plant	37.00	42.83	46.16	0.45	0.93
Pod yield / plant (g)	13.35	14.23	15.75	0.11	0.24
Pod yield / ha (kg)	980	992	1034	2.73	5.42
No. of seeds/ pod	8.00	8.98	10.51	0.12	0.25
Seed yield / plant (g)	8.20	8.35	8.68	0.25	0.47
Seed yield / ha (kg)	585	595	620	1.76	3.50

Hardened seed – Seed hardened with MgSO₄ 100 ppm

Designer seed – Hardened seed + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg

The increased seed yield could be due to the increased photosynthetic efficiency through stabilization of chlorophyll, higher production of photosynthates that resulted in increased translocation of organic material from the source to sink in the treated plants as reported (Kanchapur *et al.*, 1987) [6] on investigating the effect of seed hardening and film coating on sorghum. Suma (2005) [14] in sesame, Natesan (2006) [8] in blackgram, Sureshvegulla (2008) [15] and Selvakumari (2010) [12] in maize, reported that designer seed, the integration of

seed management techniques (hardening + coating + pelleting) improved the productivity of seeds. Similarly, Sherin (2003) [13] in maize, Vijay kumar *et al.* (2007) [17] in cotton reported that seed coating with polymer enhanced the productivity of seeds. Ananthi *et al.*, 2013 [2] in green gram and Pandiselvan, 2011 in black gram also reported that designer seed improved the seed yield.

Significant differences were observed in seed quality parameters of the resultant seeds harvested from hardened and designer seeds. Designer and hardened seed increased quality performance over control and between the treatments, designer seed performed better than hardened seed (Table 2).

Table 2: Effect of hardening and designer seed on the quality of resultant seed in green gram cv. CO 6 under irrigated conditions

Parameters	Control	Hardened seed	Designer seed	SEd	CD (P=0.05)
100 seed weight (g)	3.310	3.354	3.466	0.007	0.015
Germination (%)	90	91	94	0.23	0.45
Root length (cm)	15.4	15.9	16.5	0.05	0.11
Shoot length (cm)	21.3	31.8	22.4	0.05	0.10
Drymatter production (g / 10 seedlings)	248	255	264	0.83	1.62
Vigour index	3289	3415	3660	18.74	37.21

Hardened seed – Seed hardened with MgSO₄ 100 ppm

Designer seed – Hardened seed + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg

The hike in the performance of treated seeds might be due to the carryover beneficial effects of presowing treatments with nutrients (Kavitha, 2002) [7] to the seed quality characters of resultant seed that had been supported by higher accumulation nutrients that was expressed through the higher weight of the

resultant seed. Similar results were also reported (Suma, 2005) [14] in sesame.

Conclusion

It can be concluded that, for better results adopted the integrated seed treatment or designer seed (hardened with MgSO₄ 100 ppm + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg) recorded higher seed yield attributing

characters and resultant seed quality parameters over control seeds of greengram.

References

1. Abdul-Baki AA, Anderson JD. Vigour determination of soybean seeds by multiple criteria. *Crop Science*. 1973; 13:630-633.
2. Ananthi M, Sasthri G, Srimathi P. Integrated seed and crop management techniques for increasing productivity of greengram CV.CO 6. *International journal of scientific research*. 2013; 2(11):37-38.
3. Dharmalingam C, Paramasivam K, Sivasubramanian V. Seed hardening to overcome adversity. *The Hindu*. 1988, 16.
4. Farahani HA, Moaveni P, Maroufi K. Advances in *Environmental biology*. 2011; 5(8):2253-2257.
5. Heydecker W. Interrelated effects of imbibitions temperature and oxygen on seed germination. In: *Seed Ecology* (Ed. W. Heydecker). Butterworths. London. 1972, 157-169.
6. Kachapur MD, Hadimani AS, Vyakaranahal BS, Prabhakar AIS. *Sorghum Newsletter*. 1987; 30:39.
7. Kavitha S. Seed hardening and pelleting for maximizing the productivity of blackgram (*Vigna mungo* L. Hepper). CV.Vamban 3 under rainfed conditions. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2002.
8. Natesan P. Designing integrated seed treatment in blackgram (*Vigna mungo* (L.) Hepper) for irrigated and rainfed ecosystem. Ph.D (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2006.
9. Pandiselvam R. Development of integrated seed production techniques for blackgram var. ADT 3. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2011.
10. Panse VG, Sukhatme PV. *Statistical methods for Agricultural workers*. ICAR, Publication, New Delhi. 1985, 327-340.
11. Schneider A, Renault P. Effect of coating on seed imbibition: II. Effect of coating rates. *Crop Science*. 1997; 37(6):1850-1857.
12. Selvakumari A. Standardization of seed fortification and development of a comprehensive seed treatment for enhancing seed quality, productivity and storability of pioneer maize hybrid 31y45. Ph.D. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2010.
13. Sherin SJ. Seed film coating technology using polykote for maximizing the planting value, growth and productivity of maize cv. CO1. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2003.
14. Suma N. Seed quality enhancement techniques in sesame. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2005.
15. Suresh vegulla. Standardization of polymer coating technology for mechanization in maize hybrid COH (M) 5. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 2008.
16. Vijaya J. Standardization of pre-sowing seed management techniques for pulses. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore, India, 1996.
17. Vijaya kumar K, Ravi Hunje NK, Biradar Patil, Vyakarnhal BS. Effect of seed coating with polymer, fungicide and insecticide on seed quality in cotton during

storage. *Karnataka Journal of Agricultural Science*. 2007; 20(1):137-139.

18. Heydecker W, Coolbear P. Seed treatments for improved performance - survey and attempted prognosis. *Seed Science and Technology*. 1977; 5:353-425.