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# Evaluation of Integrated Seed Treatment on Seed Yield and Quality in Blackgram (*Vigna mungo* L.)

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## ABSTRACT

**Background:** In India pulses production and productivity is low and inadequate to meet the demand of nation. The alternate option to increase the pulse production is through seed amelioration by combining the seed hardening, coating and pelleting techniques. The current study was aimed to evaluate integrated seed treatment on seed yield and quality in blackgram.

**Methods:** The seeds were first preconditioned by keeping them in between two layers of moist gunny bag for one hour. Then, the preconditioned seeds were soaked for three hours in 100 ppm $ZnSO_4$ solution at 1/3 volume of seeds and shade dried to their original moisture content (hardened seed). Then the hardened seeds were supplemented with Polymer 3 ml/kg + Carbendazim 2 g/kg + Imidacloprid 1 ml/kg for integrated seed treatment and field experiments were carried out along with untreated seed.

**Result:** Among the seed treatments, integrated seed treatment recorded higher pod set per cent (84.00), number of pods/plant (52.00 pod yield/plant (27.60 g), pod yield/ha (752 kg), number of seeds/pod (6.00), seed yield/plant (17.6 g) and seed yield/ha (590 kg) which were respectively 3.70, 8.33, 4.15, 3.01, 20.00, 4.14 and 1.89 per cent higher than mere hardened and untreated control seeds thus suggesting that integrated seed treatment can be recommended for improving the productivity of blackgram.


**Key words:** Blackgram seeds, Carbendazim, Imidacloprid, Polymer, $ZnSO_4$.

## INTRODUCTION

Pulses are the most important seed crops in India because of their low cost high quality protein. They play a major role in providing a balanced protein component in the diet of the people in developing countries. Pulses contain a higher level of quality protein, nearly three times as much as cereals. In the world's food basket, pulses contribute to 57.5 million tonnes from 68.32 million hectares. India stands first in production as well as consumption of pulses.

The contribution of pulses by India to the global production is 27.7 per cent grown in 35.2 per cent of cultivated area. Among the pulses, the urd bean or blackgram [*Vigna mungo* (L.) Hepper], occupies unique place for its use as seed and vegetable and it is grown both as pure and mixed crop along with maize, cotton, sorghum and other millets. In India, it is cultivated both in *Kharif* and *Rabi* seasons. The present demand for the pulses in the country is estimated at about 26 million tonnes, while the production is at about 23.4 million tonnes. The low productivity is due to the reason that pulses are grown mostly in marginal and rainfed areas and also due to the lack of high yielding varieties/hybrids, poor keeping quality and lack of storage facilities.

The main constraints in raising the productivity levels of pulses in drylands are the inadequacy of soil moisture and poor fertility status of the soil. The possibility of increasing land area under pulses especially in blackgram is quite limited with the introduction of alternate land use concept. The alternate option to increase the pulse production can be through seed amelioration by combining the seed hardening, coating and pelleting techniques in both irrigated and rainfed ecosystems to improve the plant stand and growth. Moisture stress is a major constraint in dryland farming during initial establishment period which would affect the crop stand establishment and the productivity. In order to overcome these situations, a number of seed enhancement techniques have been developed. Of these, seed hardening and pelleting technology provides drought tolerance during initial phase of germination as well as essential nutrients for plant establishment and growth. Keeping these in view, the present study was conducted in blackgram to evaluate the integrated seed management techniques on seed yield and quality in blackgram.

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## MATERIALS AND METHODS

Genetically pure, freshly harvested seeds of blackgram [*Vigna mungo* (L.) Hepper] cv. ADT 3 obtained from Agricultural Research Station, Bhavanisagar served as the base material for the study. The seeds were first preconditioned by keeping them in between two layers of moist gunny bag forone hour. Then, the preconditioned seeds weresoaked for three hours in 100 ppm $ZnSO_4$ solution at 1/3 volume of seeds and shade dried to their original moisture content (hardened seed). Then the hardened seed were coated by adding with Polymer 3 ml/kg + Carbendazim 2 g/kg + Imidacloprid 1 ml/kg for integrated seed treatment (designer seed) and field experiments were carried out along with untreated control seeds.

A field trial was laid out with the above three treatments (Hardened seed, integrated seed treatment and control) adopting randomized block design with seven replications under irrigated condition. The plot size was 4 × 5 $m^2$ and the plant spacing was maintained at 45 × 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 (4×100) were taken at random from each treatment and individually sown in raised beds of 3 × 3 m @ single seed per hill in four different lines under field conditions and were irrigated immediately after sowing and life saving irrigation was given on third day after sowing. The beds were watered periodically to maintain sufficient soil moisture and after ten days of 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.

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

**Pod set (%)**

Pod setting percentage in each of the inflorescences (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 pods plant$^{-1}$**

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 yield plant$^{-1}$ (g)**

Mature and dried pods were harvested in three pickings from five tagged plants replication wise and treatment wise, cleaned and weighed individually and the cumulative yield of all pickings was reported as pod yield per plant in gram.

**Pod yield ha$^{-1}$ (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.

**Number of seeds pod$^{-1}$**

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 were reported as whole number.

**Seed yield plant$^{-1}$ (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 yield ha$^{-1}$ (kg)**

Seed yield ha$^{-1}$ was obtained by converting the data from seed yield plot$^{-1}$ and the mean reported as seed yield per hectare in kilogram. For this, 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 calculated as seed yield plot$^{-1}$ 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$^{-1}$)**

Seedlings used for growth measurement (seven days old seedling) 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) and the mean expressed in whole number.

VI = Germination (%) × [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). 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

The results of the present investigation showed that integrated seed treatment (designer seed) recorded the maximum field emergence over hardened and untreated seeds irrespective of its combination with other crop management techniques. The designer seed recorded four per cent and three per cent increase in field emergence over the control and hardened seed respectively. Dharmalingam *et al*. (1988) stated that an 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 Enhanced field emergence due to coating of seeds with nutrients was also reported by Begam, (2001) in blackgram. Similarly, Natesan (2006) in blackgram, Sureshvegulla (2008) and Selvakumari (2010) in maize reported that designer seed, the integration of seed management techniques (hardening + coating + pelleting) improved the productivity of seeds.

The recorded yield attributing characters were significantly higher in integrated seed treatment compared to hardened and control seed. The pod set per cent (84.00), number of pods plant$^{-1}$ (52.00), pod yield plant$^{-1}$ (27.60 g), pod yield ha$^{-1}$ (752 kg), number of seeds pod$^{-1}$ (6.00), seed yield plant$^{-1}$ (17.6 g) and seed yield ha$^{-1}$ (590 kg), which were respectively 3.70, 8.33, 4.15, 3.01, 20.00, 4.14 and 1.89 per cent higher than the control seeds (Table 1). Ananthi *et al*. (2017) revealed that the yield increase obtained 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 $ZnSO_4$ present in both these treatments, is the constituent of several dehydrogenase enzymes and also an activator of other enzymes. The increased pod yield alsodue to unabated reproductive structures that could have resulted due to higher photosynthetic activity.

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) on investigating the effect of seed hardening and film coating on sorghum. Suma (2005) in sesame, Natesan (2006) in blackgram, Sureshvegulla (2008) and Selvakumari (2010) in maize, reported that designer seed, the integration of seed management techniques (hardening + coating + pelleting) improved the productivity of seeds. Similarly, Sherin (2003) in maize, Vijaykumar *et al*. (2007) in cotton reported that seed coating with polymer enhanced the productivity of seeds. Ananthi *et al.* (2013) in greengram and Pandiselvan (2011) in blackgram 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

**Table 1:** Effect of integrated seed treatment on growth and yield characteristics in blackgram.

| Parameters | Control | Hardened seed | Integrated seed treatment | SEd | CD (P=0.05) |
|---|---|---|---|---|---|
| Field emergence (%) | 87 | 88 | 91 | 0.32 | 0.65 |
| Pod set (%) | 81.00 | 82.00 | 84.00 | 0.21 | 0.40 |
| No. of pods/plant | 48.00 | 50.00 | 52.00 | 0.23 | 0.45 |
| Pod yield/plant (g) | 26.50 | 27.30 | 27.60 | 0.13 | 0.29 |
| Pod yield/ha (kg) | 730 | 745 | 752 | 3.05 | 6.15 |
| No. of seeds/pod | 5.00 | 6.00 | 6.00 | 0.10 | 0.22 |
| Seed yield/plant (g) | 16.9 | 17.4 | 17.6 | 0.25 | 0.47 |
| Seed yield/ha (kg) | 579 | 585 | 590 | 2.01 | 4.05 |

Hardened seed: Seed hardened with $ZnSO_4$ 100 ppm.

Integrated seed treatment: Hardened seed + Polymer 3 ml/kg + Carbendazim 2 g/kg + Imidacloprid 1 ml/kg.

**Table 2:** Effect of integrated seed treatment on resultant seed quality in blackgram.

| Parameters | Control | Hardened seed | Integrated seed treatment | SEd | CD (P=0.05) |
|---|---|---|---|---|---|
| 100 seed weight (g) | 4.95 | 4.98 | 5.02 | 0.005 | 0.013 |
| Germination (%) | 85 | 87 | 91 | 0.20 | 0.41 |
| Root length (cm) | 13.4 | 13.9 | 14.4 | 0.05 | 0.10 |
| Shoot length (cm) | 22.7 | 23.5 | 24.1 | 0.05 | 0.11 |
| Drymatter production (g 10 seedlings$^{-1}$) | 220 | 228 | 239 | 0.87 | 1.70 |
| Vigour index | 3068 | 3254 | 3503 | 14.50 | 30.01 |

Hardened seed: Seed hardened with $ZnSO_4$ 100 ppm.

Integrated seed treatment: Hardened seed + Polymer 3 ml/kg + Carbendazim 2 g/kg + Imidacloprid 1 ml/kg.

seed (Table 2). Kavitha (2002) stated that the hike in the performance of treated seeds might be due to the beneficial effects of presowing treatments with nutrients 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) in sesame.

## CONCLUSION

The integrated seed treatment (hardened with $ZnSO_4$ 100 ppm + Polymer 3 ml/kg + Carbendazim 2 g/kg + Imidacloprid 1 ml/kg) outperformed the meare hardened and untreated seeds by registering higher seed yield attributing characters and resultant seed quality parameters in blackgram.

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