Research Journal of

Seed Science

ISSN 1819-3552

Academic Journals Inc.

www.academicjournals.com

Research Journal of Seed Science 4 (3): 174-180, 2011
ISSN 1819-3552 / DOI: 10.3923/rjss.2011.174.180

Organic Seed Pelleting in Mustard

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ABSTRACT

The cry on organic farming elaborates the need of user friendly and eco friendly technique for seed management techniques. The main aim of the study is to evaluate the quality of seeds as influenced by seed pelleting. Seed pelleting is a technique of seed encapsulation with organic, inorganic nutrient, water absorbent and pesticides and it provides an opportunity to package effective quantities of materials such that they can influence the seed or soil at the seed-soil interface. Seed pelleting is mainly adopted to smaller size seed to increase the size of seed, thereby it reduces the seed rate and improve seed germination by enriching the rhizosphere region with macro and micro nutrient that trigger the vegetative growth of seedling plant in addition to the improvement in zone specific microbial activity. The seed were pelleted with botanicals (*Pungam, Prosopis, Arappu and vasambu*), biofertilizer (*Azospirillium, phosphobacteria* and *Rhizobium*) and filler materials like charcoal and wood ash using maida 10% as adhesive without forming any aggregates using hand operated pelletizer. Highly significant differences were noticed due to organic pelleting seed treatments for all the evaluated seed and seedling quality characters. Among the treatments, seeds pelleted with *Azospirillum* enhanced the germination by 13.3% over control. The seedling quality character in terms of shoot and root length, vigour index and dry matter production had been improved by 8.1, 28.6, 32.2 and 18.8%, respectively over control. Similarly field emergence also has been increased by *Azosprillium* treatment compared to control. This study clearly expressed that pelleting of seeds with *Azospirillium* enhanced the seedling vigour.

Key words: Pellets, germination, seed size, botanicals, biofertilizers, seed vigour

INTRODUCTION

Physical seed enhancement techniques like seed pelleting resulted in more rapid and synchronous germination across seed bed environment, particularly when their seed size is very small (Halmer, 2003). Ramesh *et al.* (2001) reported that soybean seed pelleted with ammonium molybdate @ 250 mg kg^{-1} and ferrous sulphate @ 500 mg kg^{-1} and inoculated with Brady rhizobium Japonicum resulted in increased number of branches and pod $plant^{-1}$ and seed yield. Soybean seeds of cv. CO_2 pelleted with vermicompost+arappu+thiram using 10% maida as an adhesive enhanced the field establishment and seed yield (Anonymous, 2002). While Srimathi *et al.* (2002) observed that nutrient pelleting of soybean seeds with $ZnSO_4$ @ 250 mg kg^{-1} of seed using arappu leaf powder @ 250 g kg^{-1} of seed as filler enhanced the seed quality and field emergence compared to unpelleted seeds. Balamurugan (2002) reported that sesame seeds of cv.CO 1 pelleted with NH_4Mo_4+ $ZnSO_4$ + $MnSO_4$ + borax @ 300 mg each kg^{-1} using gypsum @ 300 g kg^{-1} as a filler material and

10% maida as an adhesive enhanced the seed germination by 2%,seedling growth by 4% and seed yield by 22% compared to control. Pelleting can indirectly improve seed germination and stand establishment, while nutrient pelleting enrich the rhizosphere region with macro and micronutrient that trigger the vegetative growth of seedling plant in addition to the improvement in zone microbial activity (Suma, 2005). Keeping in view the above facts, the present study was initiated with the objective of evaluation of seed quality as influenced by seed pelleting.

MATERIALS AND METHODS

Genetically pure seeds of mustard cv. GM-2 obtained from National Research Centre on Rapeseed and Mustard, Bharatpur, Rajasthan constituted the material for the study. With a view to realize the objective enumerated in the introduction chapter, the laboratory experiments was carried out in the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore between 2004 to 2007. The experimental details and methods adopted are enumerated hereunder.

Seeds were pelleted with the following materials and dosage.

Materials	Dosage
Prosopis (*Prosopis juliflora*)	200 g kg^{-1}
Pungam (*Pungamia pinnata*)	200 g kg^{-1}
Arappu (*Albizzia lebbeck*)	200 g kg^{-1}
Vasambu (*Achorus calamus*)	200 g kg^{-1}
Charcoal	200 g kg^{-1}
Wood ash	200 g kg^{-1}
Azospirillum	50 g kg^{-1}
Phosphobacteria	50 g kg^{-1}
Rhizobium	50 g kg^{-1}

For 1 kg of seed, 50 mL adhesive (10% Maida gruel) was used. The seed were pelleted thoroughly without forming any aggregates using hand operated pelletizer and following quality parameters were analyzed.

Germination: Germination test was conducted with four replicates of hundred seeds each using between paper methods in the germination room maintained at 25±2°C and 96±2% RH. The germination percentage was calculated based on the normal seedling evaluated on 7th day and it was expressed in percentage (International Seed Testing Association, 1999).

Shoot length: Five normal seedlings were selected at random in each replication and length of the shoot was measured from the collar region to tip of the primary leaf and the mean value was expressed in cm seedling^{-1}.

Root length: From the above seedlings, the length of the root was measured from the collar to tip and the mean value was expressed in cm seedling^{-1}.

Vigour index: Vigour index value was computed using the following formula suggested by Abdul-Baki and Anderson (1973) and expressed as whole number.

Dry matter production: After measuring the root and shoot length, the five normal seedlings were shade dried for 24 h and then in a hot air oven maintained at 85±1°C for 24 h. Then, they were cooled in a desiccator which contained calcium chloride for 30 min and weighed. The mean weight was expressed in mg 5 seedling^{-1}.

Field emergence: Four replications of 100 seeds were sown individually in the seed bed as line sowing. After seven days, the number of seedlings emerged were counted and reported in percentage.

Statistical analysis: The data collected for different parameters from the field and the laboratory experiments were statistically analyzed by the 'F' test for significance as suggested by Panse and Sukhatme (1985). The critical difference CD was computed at 5% probability. Where ever necessary, the% values were first transferred to angular (arc sine) value before analysis.

RESULTS

Highly significant differences were noticed due to organic pelleting seed treatments for all the evaluated seed and seedling quality characters.

Among the treatments, seed pelleted with *Azospirillum* recorded the highest germination of 90% followed by Prosopis (84%), while the minimum germination was registered by seeds pelleted with charcoal (68%). The lengthiest shoot length of 8.60 cm was registered by the seeds pelleted root length was registered by the seeds pelleted with Prosopis (17.10 cm) followed by *Azospirillum* (16.05 cm), whereas it was minimum in seeds pelleted with Vasambu (11.21 cm) which was on par with *Rhizobium* (11.23 cm). Among the treatments, seeds pelleted with *Azospirillum* recorded the maximum computed value of 2177 which was on par with seeds pelleted with *Prosopis* (2159), while it was the minimum of 1123 for the seeds pelleted with Vasambu. Seeds pelleted with *Azospirillum* recorded the maximum dry weight of 32 mg which was on par with seeds pelleted with *Prosopis* (31 mg), while it was minimum in seeds pelleted with Vasambu (13 mg). Among the treatments, seeds pelleted with *Azospirillum* recorded the highest field emergence of 85%, while the minimum field emergence of 63% was registered by seeds pelleted by charcoal, however it was on par with *Rhizobium* pelleted seeds (65%) (Table 1).

DISCUSSION

In India, the green revolution undoubtedly helped to tide over the food crisis during the last four decades. Use of chemical fertilizers is one of the major factors for increasing the food production from 50 million tonnes to 200 million tonnes. The quantum of chemical fertilizer usage has also been increased from 1.54 million less during 1967-68 to 17.31 million tonnes in 2002-03 (Kubsad *et al*., 2002). Green revolution technology is extremely exploitative and has not only showed ill-effects on natural resources but also increases the demand for inputs like fertilizers to the tune of about 28 million tonnes from the current level of 17 million tonnes and pesticides to 1.5 lakh tonnes as against current usage of 0.8 lakh tonnes. Inspite of increased use of costly inputs, it is not certain whether we could meet the challenge of feeding the people with the right quality of safe food. It is now realized that the first green revolution has weekend ecological base in addition to degrading soil, water resources and the quality of the food. At this juncture, a keen awareness has sprung in the adoption of organic farming as a remedy to cure the ills of modern

Table 1: Effect of pelleting on germination percentage, shoot and root length (cm), vigour index, dry matter production (mg 5 seedlings^{-1}) and field emergence percentage in mustard seeds cv. GM-2

Treatments (g kg^{-1} of seed)	Germination (%)	Shoot length (cm)	Root length (cm)	Vigour index	Dry matter prodnction (mg 5 seedling^{-1})	Field emergence (%)
Control	78(62.03)	7.48	11.46	1477	26	76(60.67)
Prosopis (200 g)	84(66.42)	8.60	17.10	2159	31	78(62.03)
Pungam (200 g)	78(62.03)	5.94	11.49	1360	21	70(56.79)
Arappu (200 g)	76(60.67)	5.73	11.34	1237	22	70(56.79)
Vasambu (200 g)	73(58.69)	3.43	11.21	1123	13	67(54.94)
Charcoal (200 g)	68(55.55)	7.42	12.17	1450	26	63(52.54)
Wood ash (200 g)	74(59.34)	8.21	13.07	1447	30	69(56.17)
Azhospirillium (50 g)	90(71.57)	8.14	16.05	2177	32	85(67.21)
Phospobacteria (50 g)	83(65.65)	7.43	15.01	1863	27	76(60.67)
Rhizobium (50 g)	72(58.05)	7.64	11.23	1359	26	65(53.73)
Mean	77.6(61.75)	7.00	13.01	1565	30	71.9(57.99)
SEd	1.366	0.016	0.016	25.777	1.571	1.211
CD (p = 0.5)	2.850	0.034	0.034	53.771	3.276	2.526

Values in parenthesis are arc sine values

chemical agriculture. For organic farming, organically produced seeds are very much required. Hence, the present study was conducted using botanicals and biofertilizers for pelleting of seeds.

The eco-friendly production technique for maximization of quality seed yield necessitates the use of organic, botanical and bio-fertilizers in the place of inorganic fertilizers. The researchers pointed out that inoculation of bio-fertilizers stimulate the growth (Swaminath and Vadiraj, 1988) and other micronutrients (Vinayak and Bagyaraj, 1990) and thereby increased the survival rate of planted seedlings. In the present investigation, seeds were pelleted with botanical and bio-fertilizers (Fig.1). The seeds pelleted with *Azospirillum* enhanced the germination by 13.3% over control. The seedling quality character in terms of shoot and root length, vigour index and dry matter production had been improved by 8.1, 28.6, 32.2 and 18.8%, respectively over control. Similarly field emergence also has been increased by *Azosprillium* treatment compared to control (Fig.1). The hike in germination of seeds pelleted with bio-fertilizer might be due to the increased cytokinin production which actively involved in cell division (Neiland, 1981) and production of growth regulating substances like auxin, GA and Cytokinin (Kucey, 1988). Similar results were obtained by Bhaskar *et al.* (2000) in ground nut, Srimathi *et al.* (2002) in soybean, Balamurugan (2002) and Suma (2005) in sesame. As contradictory, seed pelleting also delays germination in case of some cold crops inorder to overcome some adverse conditions. Seeds pelleted with *Eucalyptus camadulensis* leaf extract exhibited delayed germination for longer time than Ephedrine, Vanillin, Caffeine and ABA (Esfahani and Shariati, 2006). Zn was applied as soil application, seed pelleting and foliar spraying, Among Zn application forms, spray application had the highest accumulation of Zn compared to other two forms (Poshtmasari *et al.*, 2008). The crop yield of soybean seeds coated carboxymethylchitosan was increased by 17.95% (Zeng and Zhang, 2010). Conventional captan and eugenol incorporated into chitosan-lignosulphonate polymer coated seeds were capable to inhibit most of the fungi until 9 months of storage (Thobunluepop, 2009). Seed coating with bio-digested slurry 50%, superphosphate 2%, Bradyrhizobium 2%, and Phosphobacteria 2% (w/w of seed) increased the number of filled pods and grain yield by 29.6 and 37.2%, respectively over the

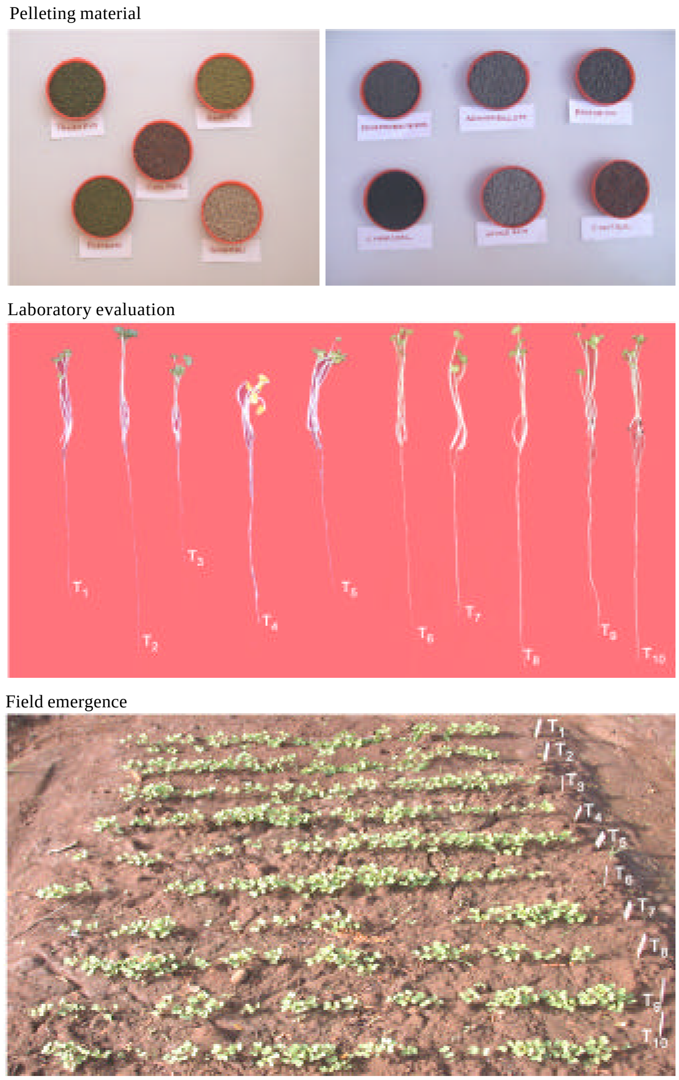

Fig. 1: Effect of organic pelleting on germination and field emergence in mustard cv. GM2

uncoated (Jeyabal *et al*., 1992). Nevertheless, CL chitosan-lignosulphonate polymer (CL) and eugenol incorporated into chitosan-lignosulphonate polymer (E+CL) coating polymer could maintain seed storability, which significantly improved seed germination and seedling performances. These improvements were attributed to maintain the nutritive reserve and dehydrogenase activity in seeds. Moreover, the biological seed treatment stimulated the embryo growth and so speeding up the seedling emergence when compared untreated seeds (Thobunluepop *et al*., 2008). *T. hamatum* soil inoculation and seed coating treatments gave the highest increase for chlorophyll a, b and cartenoids. Also the same treatments showed the highest increase of phenolic compounds (free and conjugated) and the lowest percentage for sugars content of tomato leaves infected with the concerned pathogens (El-Rafai *et al*., 2003). The variant of CL coating polymer for seed coating was only during the first 6 months of storage able to inhibit all species of the observed seed borne fungi, whereas CA and E+CL coating polymer were capable to inhibit most of the fungi until 9 months of storage (Thobunluepop, 2009). The biological coated seeds were found to maintain high sugar contents inside the seeds, which resulted high seed storability significantly. In contrast, under fungicide stress (CA), those compounds were lost that directly affected seed vigor during storage (Thobunluepop *et al.*, 2009). The *in vitro* studies showed that a 70% concentration of the culture filtrate of *S. aureofaciens* significantly inhibited the spore germination, mycelial growth and sporulation of *Fusarium solani*. The *in vivo* studies involved different treatments. Seed coating treatment was the most effective in controlling *F. Solani* at all cultivation periods in all the three-sugarbeet cultivars Raspoly, TOP and Tribel (Tarek Moussa and Mohamed Rizk, 2002). The biological coated (biological fungicide polymers [chitosan-lignosulphonate polymer (CL) and eugenol incorporated into chitosan-lignosulphonate polymer (E+CL)])seeds were found to maintain high sugar contents inside the seeds, which resulted high seed storability significantly in rice cv. KDML 105 (Thobunluepop *et al.*, 2009).

CONCLUSION

The studies on seed pelleting with botanicals (*Pungam, Prosopis, Arappu and vasambu*), biofertilizer (*Azospirillium, phosphobacteria* and *Rhizobium*) and filler materials like *charcoal* and *wood ash* using maida 10% as adhesive revealed that the seeds pelleted with *Azospirillum* @ 50 g kg^{-1} registered maximum germination (90%), shoot and root length of 8.14 and 16.05 cm, respectively. Similar result was also observed for vigour index, dry matter production and field emergence.

REFERENCES

Abdul-Baki, A.A. and J.D. Anderson, 1973. Vigor determination in soybean seed by multiple criteria. Crop Sci., 13: 630-633.

Anonymous, 2002. Area and Production of Principal Crop in Agricultural Facts and Fig. Commissioner of Agriculture, Pune, Maharashtra, India, pp: 150-154.

Balamurugan, V.M., 2002. Nutrient management for seed yield maximization in rainfed sesame (*Sesamum indicum*L.) cv. CO 1. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, India.

Bhaskar, S., Shivashankar, K.G.J. Dhan and C. Ramchandra, 2000. Gypsum and sulphur nutrition to groundnut. Int. J. Trop. Agric., 18: 355-360.

El-Rafai, I.M., M.W.S. Asswah and A.O. Awdalla, 2003. Biocontrol of some tomato disease using some antagonistic microorganisms. Pak. J. Biol. Sci., 6: 399-406.

Esfahani, M.N. and M. Shariati, 2006. The use of seed pelleting in order to delay germination of *Trifolium repens* L. Pak. J. Biol. Sci., 9: 893-897.

Halmer, P., 2003. Enhancing seed performance for better yield and quality. Asian Seeds Plant Mater., 10: 4-7.

International Seed Testing Association, 1999. International rules for seed testing, Rules 1999. Annex to Chapter 5: The germination test. Seed Sci. Technol., 27: 27-32.

Jeyabal, A., G. Kuppuswamy and A. Lakshmanan, 1992. Effect of seed coating on yield attributes and yield of soybean (*Glycine max* L.). J. Agron. Crop Sci., 169: 145-150.

Kubsad, V.S., U.K. Hulihalli, V.R. Naik and G.G. Gulaganji, 2002. New methods of weed control. Bilingual Monthly Magazine, Swarna Sedyam-Agri Gold, India, pp: 50.

Kucey, R.M.N., 1988. Alteration of size of wheat root systems and nitrogen fixation by associative nitrogen-fixing bacteria measured under field condition. Can. J. Micribiol., 34: 735-739.

Neiland, J.B., 1981. Microbial iron compounds. Annu. Rev. Biochem., 50: 715-731.

Panse, V.G. and P.V. Sukhatme, 1985. Statistical Methods for Agricultural Workers. ICAR Publication, New Delhi, India..

Poshtmasari, H.K., M.A. Bahmanyar, H. Pirdashti and M.A.A. Shad, 2008. Effects of Zn rates and application forms on protein and some micronutrients accumulation in common bean (*Phaseolus vulgaris* L.). Pak. J. Biol. Sci., 11: 1042-1046.

Ramesh, K., V. Thirumurugan and B. Chandrasekaran, 2001. Effect of nutrient uptake and productivity of soybean (*Glycine max*). Indian J. Agron., 46: 506-510.

Srimathi, P., K. Malarkodi, R. Geetha and V. Krishnaswamy, 2002. Nutrient pelleting to augment quality seed production in soybean. Seed Res., 30: 186-189.

Suma, N., 2005. Studies of seed quality enhancement techniques in sesamum (*Sesamum indicum* L.) cv. Co 1 in sesamum. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore.

Swaminath, M.H. and B.A. Vadiraj, 1988. Nursery studies on the influence of Azospirillum bio-fertilizer on the growth and dry matter of forestry species. My forest, 24: 289-324.

Tarek Moussa, A.A. and A. Mohamed Rizk, 2002. Biocontrol of sugarbeet pathogen *Fusarium solani* (Mart.) Sacc. by *Streptomyces aureofaciens*. Pak. J. Biol. Sci., 5: 556-559.

Thobunluepop, P., E. Pawelzik and S. Vearasilp, 2008. The perspective effects of various seed coating substances on rice seed variety khao dawk mali 105 storability I: The case study of physiological properties. Pak. J. Biol. Sci., 11: 2291-2299.

Thobunluepop, P., 2009. The inhibitory effect of the various seed coating substances against rice seed borne fungi and their shelf-life during storage. Pak. J. Biol. Sci., 12: 1102-1110.

Thobunluepop, P., W. Pan-in, E. Pawelzik and S. Vearasilp, 2009. The perspective effects of various seed coating substances on rice seed variety khao dawk mali 105 storability II: The case study of chemical and biochemical properties. Pak. J. Biol. Sci., 12: 574-581.

Vinayak, K. and D.J. Bagyaraj, 1990. Selection of efficient VA mycorrhizal fungi for *Trifoliate* orange. Biol. Agric. Hort., 6: 305-311.

Zeng, D.F. and L. Zhang, 2010. A novel environmentally friendly soybean seed-coating agent. Acta Agric. Scand. Section B: Soil Plant Sci., 60: 545-551.