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Synthetic polymer based coating of fodder cowpea seeds enhances germination and vigour

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Introduction

In Indian arid and semi-arid conditions, comparatively less fertile lands are allotted to forage crops. In addition, erratic weather condition makes the situation more complex where proper seedling emergence and establishment of pastures with economic use of input remains a big question. Our view is that crop seedling production from seed sown into arid or semi-arid environments could be significantly enhanced by the use of simple seed coating technologies. Such approaches would make use of newly synthesised seed coat-applied polymers that could be used to hold the desired supplements like powerful germination enhancement chemicals and plant protectants with seed to support both germination and seedling establishment under the crucial stages. This approach would be expected to increase the rate and speed of germination, thereby bringing the uniformity in plant population even under stressful (drought) growing conditions. On the other hand, cowpea seed are highly susceptible to insect pest during storage in addition to seed borne diseases. Hence, coating of seed was envisaged in order to protect the seeds from pest attack and boost initial seedling vigour.

Materials and Methods

Cowpea variety EC 4216 was used for this experiment. Seed coating polymer from Incotec private Ltd. was taken as base for coating. It acted as harbour of added chemicals for protection from insect-pests, nutrient mixture (N, P, K, Fe, Mg, Zn, Mn, B, Cu, Mo and Co) and growth regulator (GA_3) for boosting up the initial growth. The plant protectants were used as half dose of recommended practice. The components were standardized after repeated trials to find the best combination that could enhance vigour and storability. Seeds were coated through a commercial seed coating machine. Growth regulator (GR), fungicide (F), insecticide (I), nutrient mix (N), rhizobium (R) and synthetic polymer (P) were put sequentially in layers on the seed surface. Stored the seeds under ambient conditions in a cloth bag for one and half months which is normal time lapse in treating, marketing and sowing of coated seeds, then the seeds were tested for germination and seed vigour traits as per standard methods of ISTA (2008). Insect feeding trial was conducted by placing 12 number of bruchides per closed petridish of seeds during its peak multiplication time and then the seed infestation percentage was recorded. The best treatment in terms of germination and vigour was tested in field condition taking uncoated seed as control.

Results and Discussion

The results indicate that, the coated seeds exhibited enhanced initial boost to germination traits as compared to control (Fig1). When plant protectants (fungicide- Bavistin @2g/kg seed and insecticide- Malathion @ 2g/kg seed), nutrient mix (N- 0.613%, P- 12.5%, K- 1.4%, S- 4.0% and other micronutrients in minute concentration), rhizobium (*R. leguminosorum*) and PGRs (GA_3 100ppm) were sequentially coated on seed surface followed by polymer coat, it became the best treatment in terms of germination (96% as compared to 90% in control) and seedling traits (Table1). In storage, the seeds coated with fungicides (Bavistin @ 2g/kg seed) and insecticides (Malathion @2g/kg seed) showed more protection as compared to control (Fig. 2). In case of uncoated seeds, bruchides damaged the total seed lot just within four months of storage however coated seeds maintained its quality by restricting the damage caused by bruchides. Protein content of the germinated seedling after three months of seed storage was also influenced by coating with nutrients, PGRs etc (data has not been presented). The best treatment of laboratory condition produced more seed yield (1.92 q/ha) as compared to control (1.74 q/ha).

Polymer itself solely may not have any boosting effect, rather it reduces germination sometimes. But when it is combined with PGR, nutrients and plant protectants, it holds the materials at desired place and delivers excellent plant performances by cumulating the effects of all additives. The germinating seeds and emerging seedlings get protected by both polymer and plant protectants in adverse field condition. Then the seedlings potentially use the nutrients and PGRs in sustainable manner so that the effect could be longer as manifested in uniform and better plant stand (Matthew *et al.*, 2013). It fastens the uniform vegetative growth, crop establishment and flowering followed by good seed yield. In storage, the wastage of

plant protectant powders becomes negligible due polymer coating over seed and uses the full potential of those chemicals. The physiological processes in seed during storage get minimum exposed to external hazards due to barrier of coating hence deteriorative reactions lose pace and seed maintains vigour for longer period.

Table1: Effect of different coating treatments on cowpea seed germination (%), shoot length (cm), root length (cm), seedling dry-wt (mg)

Treatments	Percent germination	Shoot length (cm)	Root length (cm)	Seedling dry-wt (mg)
Control	90.0	16.5	14.8	3.44
P	89.3	16.1	14.9	3.39
P+GR	90.0	17.8	16.1	2.78
P+N	88.7	15.7	15.8	3.16
P+R	90.0	16.6	14.4	3.53
P+F	91.3	17.1	14.9	3.38
P+GR+N	94.7	18.6	16.6	3.63
P+GR+R	91.3	16.4	14.1	2.48
P+GR+F	93.3	16.7	15.6	3.06
P+N+R	88.7	15.3	15.9	3.35
P+N+F	92.0	15.7	15.5	3.24
P+R+F	93.3	17.2	14.4	3.61
P+GR+N+R	94.0	18.5	16.4	3.89
P+GR+N+F	95.3	17.7	16.5	3.17
P+GR+R+F	94.7	17.4	16.3	3.24
P+R+N+F	94.7	17.3	16.0	3.14
P+GR+R+F+N	96.0	18.8	16.9	3.92

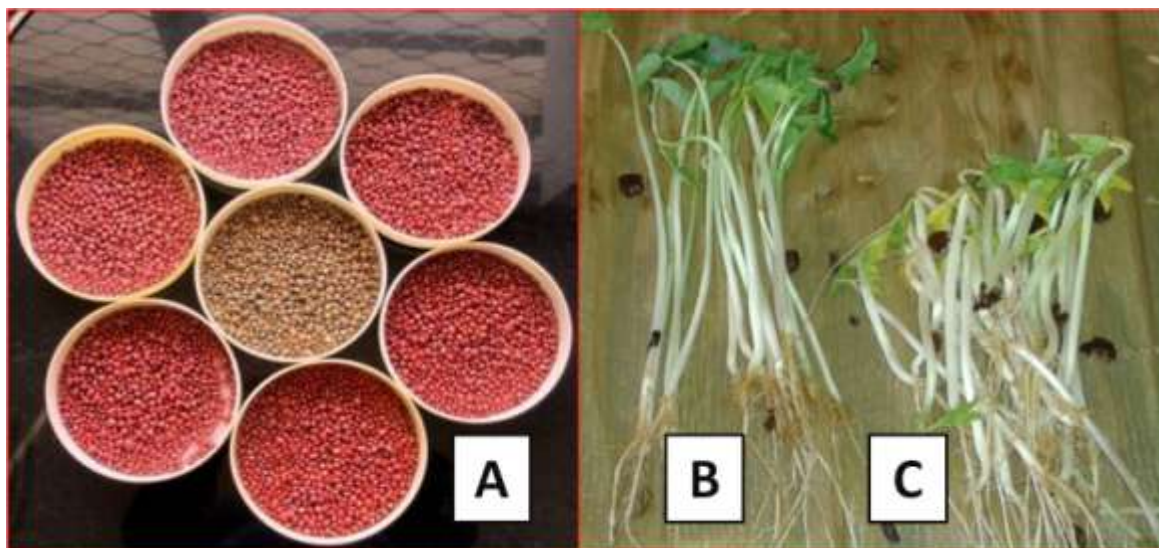


Fig. 1: Coated seed of cowpea (uncoated seed at centre) (A), Seedling of coated (B) and uncoated (C) seed at end of germination test

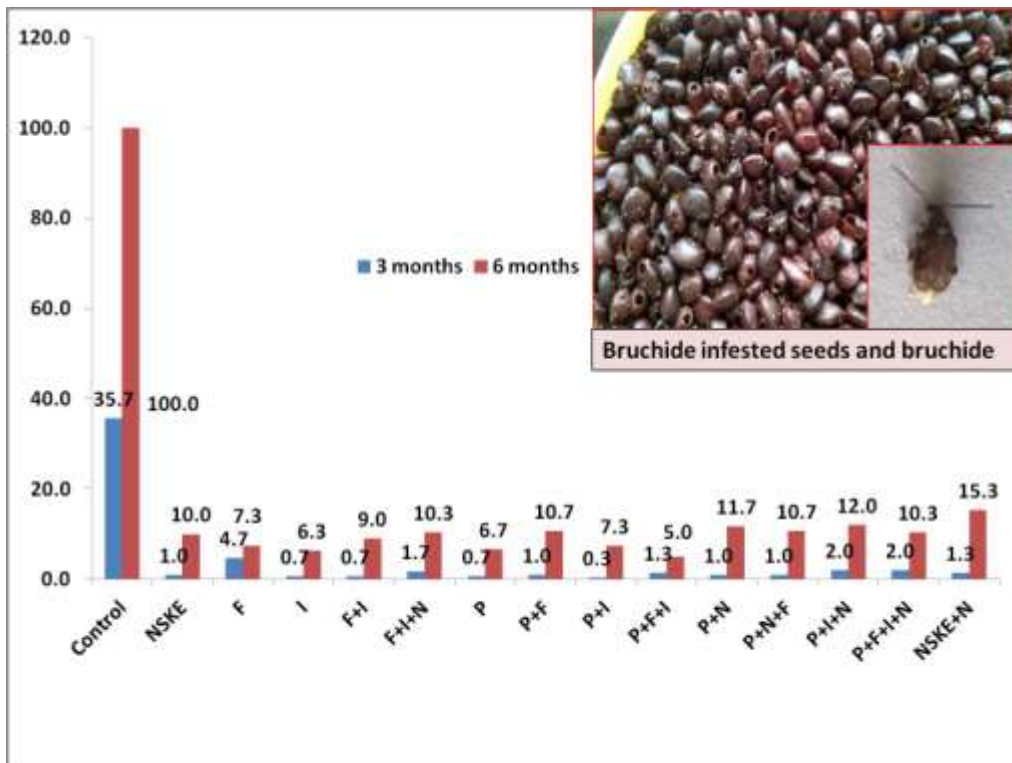


Fig. 2: Effect of different coating treatments on percent seed damaged by bruchide (inset Bruchide infested seeds and bruchide)

Conclusion

Seed coating, when all supplements are combined properly and delivered at right time, can enhance the seed performance at storage as well as field condition.

References

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