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Seed standards and seed testing protocols for forage legume seeds

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Introduction

Seed is the basic agricultural input and its quality is extremely important. In the absence of seeds of assured quality, the expenditure of the farmers on the other inputs may become of little use. It was in this context, seed legislation is in force in majority of the crops cultivated across the country to ensure the availability of high quality seeds to the farmers. The seed quality parameters (known as Indian Minimum Seed Certification Standards, IMSCS) of a notified variety of various crops (*viz.*, forages, cereals, millets, pulses etc) have been published through Gazette notifications by the Government of India from time to time. However, in majority of forage crops seed standards have not been formulated and the quality of seed made available to the farmers cannot be regulated as envisaged under seeds act. Therefore, an attempt has been made to develop seed standards and seed testing protocols in three important forage range legumes (*Centrosema pubescens*, *Desmanthus virgatus* and *Macroptilium atropurpureum* cultivated by the farmers across the country.

Materials and Methods

Tests were conducted on seed lots to quantify their physical purity (inert matter, total weed seeds, other crop seeds *etc*), germination, moisture content, test weight etc using the methodology given by the International Seed Testing Association (ISTA, 2003). The purity of a seed lot is the weight of pure seeds divided by the weight of pure seeds plus debris (inert matter) and is presented on a percentage basis. Debris commonly found in seed lots includes achenes, seed wing remnants, pollen cones, insects, damaged seed, rocks, and other inert matter. The purity of a seed lot must be as high as possible. Exceptions to this rule may occur if it is thought that further processing will adversely affect seed lot quality. The moisture content of seeds is calculated on a fresh weight basis by following ISTA procedure. Test weight (1000 seed weight) of the seed is calculated by counting the seeds and expressed in grams.

Results and Discussion

Centrosema pubescens

Physical purity analysis: The seed collected from different seed lots indicates that *Centrosema* seeds are by and large bold in size, free from insect damage, weed seeds and diseases. Upon the evaluation of physical purity of number of samples, the average minimum pure seed fraction worked out to be 98 %, the remaining 2 % of seed lot consisted of debris, pod husks, rocks and soil portion (Table 1). The mean other crop seed is standardized to the maximum permissible limit of 20/kg of seeds. Likewise, the maximum permissible total weed seeds are 20/kg of seeds. With regards to the other distinguishable varieties in a seed lot, none is permitted since this crop does not have any other released varieties in the market. Similarly, no objectionable weed seeds are found in the seed lots tested for purity analysis (Parihar *et al.*, 2013).

Seed testing protocols: The germination test is probably the test that first comes to mind when thinking of seed testing as it has immediate implications for seed quality and estimating the number of seedlings that can be obtained from a quantity of seeds. Among the substrata, between paper (BP) method of germination was proved better over top of paper (TP) method. The main features of a seed pre-treatment protocol are to overcome the barriers of seed germination (hard seed coat, dormancy etc) of a seed lot. The initial germination evaluation has exhibited large scale hard seed contents in the seed lot. To overcome the hard seededness, different hard seed coat dormancy breaking treatments were evaluated. Among the different pre-treatments, soaking of seeds in hot water for five minutes has recorded the maximum germination percentage of 93 % (including the hard seeds). The average moisture content of seed lots evaluated is 9.0 %, whereas, the moisture content for vapour proof containers is 7.0 % (Table 2). Similarly, the average test weight (1000

seed weight) of the seed lot is 26.74 g. The above standards are developed by taking into consideration with the available seed lots across the country.

Desmanthus virgatus

Physical purity analysis: The seeds of *Desmanthus virgatus* are small, typically pyramidal and brown in colour. The physical purity analysis of seed lots resulted in 98 % of physical purity and 2 % of inert matter in the seed lot (Table 1). The maximum permissible limit of other crop seeds in a lot is 20/kg of seeds and the maximum total weed seeds permissible is 10/kg of seeds. On the contrary, none other distinguishable varieties are permissible in this crop due to non availability of other released varieties.

Seed testing protocols: Germination testing is considered as the most important quality test in evaluating the planting value of a seed lot. The result of different experiments carried out to standardize the substrata revealed that between paper (BP) method is the best suited method to test the germination in this crop. Unlike *Centrosema* seeds, *Desmanthus virgatus* seeds are covered with hard seed coat which is evident from the test results. Hence, different dormancy breaking treatments were evaluated and found that acid scarification with Conc.H₂SO₄ for 1 min. recorded the maximum germination percentage (98.0), it is followed by mechanical scarification with sand paper method which recorded the 96.5 % of germination (Russi *et al.*, 1992). The average moisture content of seed lots evaluated is 9.0 %, whereas, the moisture content for vapour proof containers is 7.0 % (Table 2). The average test weight (1000 seed weight) of the seed lot is 4.61 g. Similar procedures and results were also obtained by Pallavi *et al.*, (2014) in *Abrus precatorious*

Macroptilium atropurpureum

Physical purity analysis: Commonly called as siratro, is a creeping or climbing legume. Fruit is bean like pods that are narrow, 5-10 cm long. Seeds are light brown and black, 4mm long, 2mm wide. The seeds collected from the limited sources available was evaluated for its purity analysis recorded 98 % of physical purity and 2.0 % of inert matter which included stubbles, achiness, husk soil particles etc (Table 1). The mean other crop seeds standardized to the maximum permissible limit of 20/kg of seeds. Likewise, the maximum permissible total weed seeds per kg of Siratro seeds are 10 numbers per kilogram of seeds. Since there are no other varieties available in the market, none seeds are permitted for other distinguishable varieties. No objectionable weed seeds are found in the seed lots tested for purity analysis.

Seed testing protocols: The fresh seeds of siratro were evaluated for germination under laboratory conditions recorded higher number of hard seeds (88 %) in the seed lot. To overcome the hard seed coat dormancy, soaking of seeds in Conc.H₂SO₄ for 1 min resulted in better seed germination percentage of 98 % (including the hard seeds). The average moisture content of seed lots evaluated is 9.0 %, whereas, the moisture content for vapour proof containers is 7.0 % (Table 2). Similarly, the average test weight (1000 seed weight) of the seed lot is 14.59 g.

Table 1. Mean data of seed standards and seed testing protocols of different forage range legumes

Factor	Seed standards		
	<i>Centrosema pubescens</i>	<i>Desmanthus virgatus</i>	<i>Macroptilium atropurpureum</i>
Pure seed (min.)	98 %	98%	98 %
Innert matter (maximum)	2.0 %	2.0%	2.0 %
Other crop seed (max.)	20/kg	20/kg	20/kg
Total weed seed (max.)	10/kg	10/kg	10/kg
Other distinguishable varieties (max.)	None	None	None
Objectionable weed seed	None	None	None
Germination including hard seed (min.)	93 %	98%	98 %
Moisture (max)	9 %	9%	9 %
Moisture for vapour proof containers (max)	7 %	7%	7 %
Test weight (1000 seed)	26.74 g	4.61 g	14.59 g

Table 2. Seed testing protocols for different forage range legumes

Crop	Substrate	Temperature (°C)	First count (days)	Final count (days)	Remarks
<i>Centrosema pubescens</i>	BP*	25-30	4	10	Hot water treatment
<i>Macroptilium atropurpureum</i>	BP	25	4	10	H ₂ SO ₄
<i>Desmanthus virgatus</i>	BP	20-30	7	21	Mechanical scarification, H ₂ SO ₄

*Between paper towel method

Conclusion

The seed standards and seed testing protocols standardized for measuring the seed quality parameters viz., physical purity, genetic purity, germination, seed moisture and seed health in above mentioned range legumes is essential for assessing the quality of seed for seed trade and seed sowing. Therefore, the standards developed are the base for seed lot and quality determination in these range legumes.

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