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STUDIES ON SEED DORMANCY OF BROAD LEAF MUSTARD AND GARDEN CRESS

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ABSTRACT

Seed dormancy of broad leaf mustard (*Brassica juncea var. rugosa*) and cress (*Lepidium sativum*) was studied at Lumle Centre (1670m asl) during the year 1995/96. Dormancy intensity was very strong in cress (>95%) and broad leaf mustard (94%). Average dormancy period in cress (var. Kathmandu Local) and BLM (var. Marpha Local) was 24 and 38 weeks, respectively. The treatments consisting of potassium nitrate (0.2%) solution plus prechilling for 3 days was effective to break dormancy of cress (var. Kathmandu Local) by which 90% germination was achieved. Prechilling for 5 or 7 days alone or in combination with 0.2% potassium nitrate was effective to break the dormancy of broad leaf mustard (var. Marpha Local)by which germination achieved was about 90%.

Additional Key Words: *Brassica juncea var. rugosa,* germination, *Lepidium sativum,* potassium nitrate, prechilling.

INTRODUCTION

Seed dormancy causes a failure of or delay in germination under faforable condition of moisture, temperature and oxygen supply (Bradbeer, 1988). Oftentime it is a problem for the seed analyst in laboratory and if it is for long time, it may be a problem for agriculturists and farmers. This problem was mainly felt in vegetables seeds while testing the samples at LARC's seed laboratory. Unless dormancy is broken completely before carrying out the germination test, one cannot expect a reliable germination result. The International Seed Testing Association (ISTA) has made some recommendations for dormancy breaking of seeds (ISTA, 1985). However, these recommended treatments could not break the dormancy in broad leaf mustard (Panthee, 1994). Complete dormancy breaking before germination test is a very important task in a seed laboratory. Moreover, information on intensity and duration of all seeds is necessary to a seed analyst in a seed laboratory. Such information is lacking in broad leaf mustard (BLM) and Cress seeds.

Intensity of seed dormancy in fingermillet was found as high as 84%, which could be broken down by predrying at 40, 45 or 50°C followed by seed soaking at 0.2% solution of potassium nitrate (CSSTD, 1992). Similarly, diversity in seed dormancy and the relationship between seed dormancy and maturity were studied in 147 *Setaria italica* germplasm accessions grown at Patancheru, India, which clearly revealed that seed dormancy could be genotype specific and some treatments could be partially effective to break dormancy (Sastry *et al*, 1995).

This experiment was carried out with an objective of determining the extent and duration of dormancy of Locally produced broad leaf mustard and cress seeds and to develop an appropriate dormancy breaking technique and improve up on germination percentage of these seeds.

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MATERIALS AND METHODS

Broad leaf mustard (var. Marpha Local) and Cress (var. Kathmandu Local) seeds were collected from seed production sites and taken to Lumle Centre (1670 m asl) immediate after harvest in 1995. Seed of Broad leaf mustard was collected from Salija (2000-2200 m asl) whereas that of Cress was collected from Deupur (1000-1200 m asl).

The seeds were stored in polythene bag (300 gauge) under laboratory conditions at Lumle Centre. Treatments used were 1. 0.2% solution of Potassium Nitrate (KNO_3), 2. Prechilling at 5-7°C for 3 days (Prechill I), 3. Prechilling at 5-7°C for 5 days (Prechill II), 4. Prechilling at 5-7°C for 7 days (Prechill III), 5. Potassium Nitrate + Prechilling at 5-7°C for 3 days, 6. Potassium Nitrate + Prechilling at 5-7°C for 5 days, 7. Potassium Nitrate + Prechilling at 5-7°C for 7 days, and 8. No treatment (Check). There were four replication of each treatment.

The cress seeds were harvested during first week of May and that of BLM in first week of June. The first germination test was carried out about 10 days after harvest and the subsequent tests were carried out at 15 days interval. The germination test was carried out on top of the paper (TP) for both the species at 20-25°C. Study was continued so long as there was almost no dormant seeds. In germination test, normal seedlings, abnormal seedlings, fresh (dormant) seeds and dead seeds were recorded. But for statistical analysis, total of normal and abnormal seedlings was considered as a number of germinated seeds. Only fresh seeds were regarded as dormant seeds while dead seeds were ignored from the analysis. Results were analyzed using MSTAT software.

RESULTS AND DISCUSSION

Broad Leaf Mustard (BLM)

The seeds of broad leaf mustard (BLM) (Var. Marpha Local) showed an initial seed dormancy intensity up to about 94%. A sharp decline in dormancy took place up to 12 weeks and reached around 30%. But the rate of natural dormancy breaking was very steady at later stage, which continued even up to 38 weeks. Complete dormancy breaking could not be observed even after 38 weeks (Fig. 1). These results were similar with the previous one (Panthee, 1995). Results of both the experiments indicated that dormancy period in this variety of BLM was more than 38 weeks and an appropriate dormancy breaking technique before germination test within this period is essential.

Such a long dormancy period is present in other crop species too. Dormancy period was found more than 6 months in white clover (Rai *et al.*, 1996). Furthermore, seeds of some cotton cultivars and their hybrids showed normal germination only after storage for about 2 years (Patil, 1976). In all crop species having such long dormancy period, appropriate dormancy breaking measures need to be adopted before carrying out the germination test.

There were strong differences among the treatments for breaking dormancy of BLM seeds. Prechilling for 5 or 7 days alone or in combination with 0.2% KNO_3 were the best for dormancy breaking of BLM seeds (Table 1). However, use of potassium nitrate alone had no effect at all. Although potassium nitrate has been recommended by ISTA to break seed dormancy of most of the crucifers (ISTA, 1985), it was not effective in the present experiment and was not found effective by Negi *et al* (1983) too.

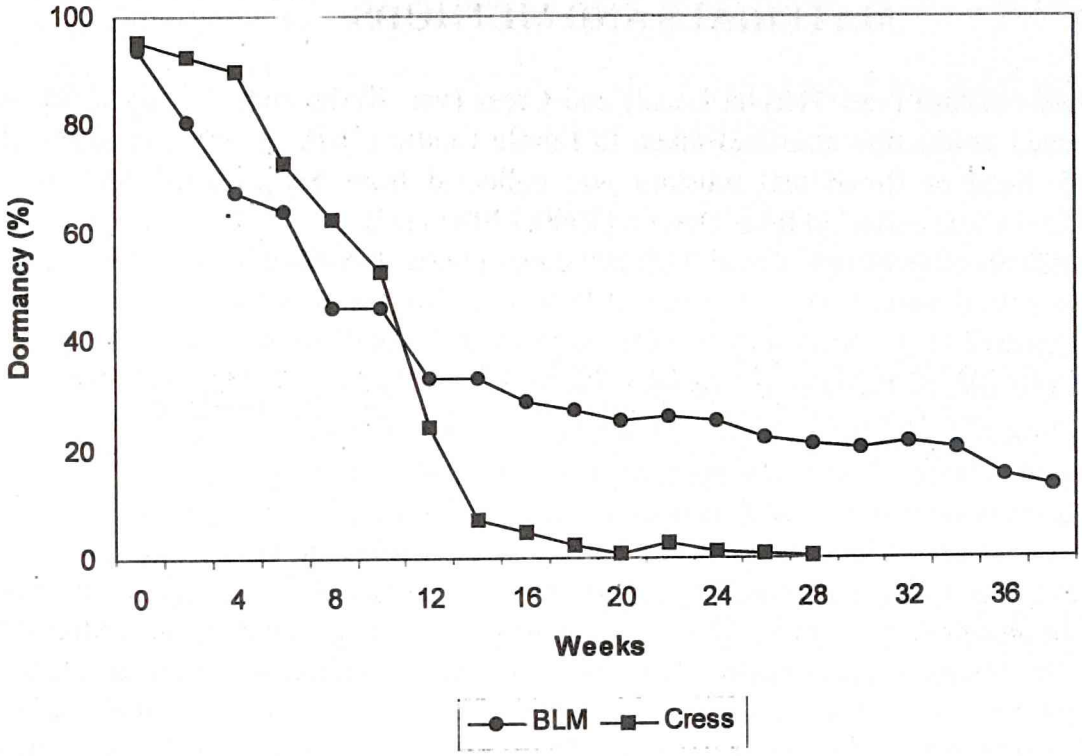

Figure 1: Intensity and duration of dormancy in BLM (var. Marpha Local) and cress (var. Kathmandu Local) seeds, 1995.

It should be noted that there was not much difference between prechilling for 5 days alone or in combination with potassium nitrate, so there is no point of using KNO_3 in combination with prechilling since the later one was not effective. However, when prechilling period was increased to 7 days, addition of KNO_3 enhanced seed germination (Table 1). So the best treatment for dormancy breaking of BLM is a combination of KNO_3 with prechilling for 7 days. There was no much difference between use of potassium nitrate and control.

Overall treatments used in this experiment can be grouped into two i.e. physical and chemical. Generally, physical treatments are effective to break the dormancy related with seed coat whereas, chemicals are effective to break the dormancy related with embryo (Ghosh and Birua, 1997). Since prechilling played more important role in dormancy breaking of BLM seeds, perhaps seed coat related factors are involved in causing the dormancy in this species. Ghosh (1962) has discussed the role of environmental factors on inducing dormancy during growing period on rice, and Panthee (1994) clearly observed that radish seeds gown at low altitude had less dormancy intensity as well as duration than those at high altitude. This means higher the growing temperature experienced by a crop lesser the dormancy and *vice versa*. If it is true, it will not be surprising to have high intensity of dormancy for long time in BLM seeds. Because, the crop is grown around 2000 m asl altitude and generally it receives a couple of snow along with several freezing days. Furthermore, the temperature rarely exceeds 24°C during flowering stage. This environmental factor should have caused high intensity of dormancy for long time in BLM seeds.

Table 1 Effect of different treatments on dormancy breaking of broad leaf mustard (var. Marpha Local Local) and cress (var. Kathmandu Local) seeds, as measured by germination (%), 1995.

S.No.	Treatments	BLM	Cress
1.	Potassium nitrate (KNO_3)	0.50	0.31
2.	Prechill I	77.31	75.56
3.	Prechill II	85.69	79.56
4.	Prechill III	84.94	65.44
5.	KNO_3 + Prechill I	69.63	90.25
6.	KNO_3 + Prechill II	85.88	77.94
7.	KNO_3 + Prechill III	89.31	75.31
8.	Control	0.13	1.50
	CV (%)	30.94	10.21
	SEm (Treatment)	2.44	1.11
	SEd (Treatment)	3.45***	1.57***

Cress

The initial intensity of dormancy in cress seeds was up to 95% but a sharp decline in dormancy took place naturally up to 14 weeks by this time, the dormancy was only around 7%. It took about 24 weeks for complete breakdown of the dormancy (Fig. 1). It is noted that the level of dormancy observed after 14 weeks in cress seeds was very low. Probably, this level of dormancy is not much important for an agriculturists, but certainly it is important for a seed analyst. This type of trend has been reported in other species too. For example, initial dormancy of grain amaranth (*Amaranthus spp.*) was more than 70%, and it took more than 9 months for natural breakdown (Ghosh and Birua, 1997).

Although there was a quite strong dormancy for long time in cress seeds, it was possible to break it artificially. All the treatments were significantly different ($P<0.001$) from each other for breaking seed dormancy of cress (Table 1). A combination of 0.2% potassium nitrate solution and prechilling for 3 days was most effective treatment to break the dormancy of cress seeds. There was not much difference between the seeds treated with 0.2% potassium nitrate alone and control, but rest of the treatments had some positive effect on dormancy breaking (Table 1). On the basis of these results, we can use the combination of prechilling and potassium nitrate to treat the cress seeds before carrying out germination test in the laboratory.

Contrary to BLM seeds, a treeatment combinations of chemical (KNO_3) and physical (prechilling) were effective to break dormancy of cress seeds. Therefore, the type of dormancy should be related with seed coat as well as embryo as discussed by Ghosh and Birua (1997). If we look at the findings of other experiments either physical, chemical or a combination of both are effective to break the dormancy of seeds. For example, freshly harvested seeds of sunflower were chilled at 5°C and soaked in 1-2% solutions of KNO_3 to break its seed dormancy (Ankaiah *et al*, 1993) indicating that seed coat as well as embryo related factors were involved in causing dormancy. Krishnasamy and Palaniappan (1990) found GA_3 (4%) and KNO_3 (200 PPM) more or less equally effective for dormancy breaking of brinjal seeds indicating that only embryo related factors were involved in this species.

Experiments conducted on rice by Kapur *et al* (1988) revealed that 'Peroxidase' activity was high in hulls of dormant seeds and it was very low in hulls of non-dormant seeds. Soaking seeds in 500 µg GA/ml or 0.2% KNO_3 for 24 hours completely removed the dormancy and significantly reduced Peroxidase activity in the hulls. It means in Cress and BLM seeds, there

might be Peroxidase activity causing dormancy in addition to other compounds, which needs prechilling in addition to potassium nitrate to release it from the seeds.

CONCLUSION

Dormancy intensity in BLM (var. Marpha Local) is about 94% but it can be broken down by giving a treatment of prechilling for 5 or 7 days alone or in combination with 0.2% potassium nitrate. Dormancy intensity in cress seeds in the beginning is around 95% but it can be broken by a combination of 0.2% solution of potassium nitrate with prechilling for 3 days. These treatments can be used to estimate germination percentage in a seed laboratory. Farmers and agriculturists can use seed rates in the species as recommended if the seeds do not have dormancy. But in case of other species having different intensity of dormancy, if they are going to plant the seed immediate after harvest without giving any dormancy breaking treatments, they will have to increase the seed rate to get a required plant stand.

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