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EFFECT OF HEATING ON THE QUALITY OF BIRDSFOOT TREFOIL SEEDS

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The loss of seed viability during the harvest of birdsfoot trefoil (Lotus corniculatus L.) seed is a problem which is often encountered in commercial seed production. The seed pods of this crop are highly susceptible to shattering prior to harvest, if they are allowed to completely desiccate. Consequently, the producer must harvest his seed crop before the pods, and therefore the seeds inside, are completely dry. Combine run seed may also contain a significant amount of green leaves and stems which add moisture to the seed. The moist seeds, and the green material in with the seed, serve as a ready substrate for the growth of aerobic molds and yeasts. As soon as the seed is harvested and stored in bulk in either bins or bags, the seed will begin to heat as a result of the growth of these molds and yeasts.

The heating may cause the poor seed viability which is detected either by the standard germination tests, or, if the seed is not tested, in the field after planting. In this study, we have attempted to quantify the effects of heating on see viability to determine the critical temperature and the critical length of heating exposure which might be expected to significantly reduce seed viability at different seed moisture levels.

A commercial certified seedlot of birdsfoot trefoil cv. Leo was moistened with a volume of water sufficient to increase the moisture content of the seed to the desired level. Seeds at each moisture level were sealed in a glass container for at least 24 hours at room temperature to ensure that the added moisture was evenly distributed among seeds within the lot.

The length of heating required to reduce seed viability was determined in the first experiment. Seeds which had been equilibrated to 11, 14 and 20% moisture were sealed in test tubes to prevent moisture loss and incubated at 40° for 1, 2, 3 or 4 days. The germination of lots before heating was 94%. In the seed lot at 11% moisture, 3 days heating at 40° was required to reduce viability, but at the higher moisture contents, 14 and 20%, viability was significantly reduced after 1 day (Table 1). Prolonged heated at 40°C resulted in a complete loss of seed viability. The higher the moisture content of the seed lots was, the more rapid the deterioration.

In the second experiment, seeds at three moisture levels, 12, 14 and 20%, were heated over a range of temperatures for 1 day to determine the critical temperature inducing deterioration. The germination of seed lots incubated at 30°C was not significantly reduced (Table 2). As temperatures increased above 30°C, viability was lost and at any given temperature, the loss of viability was greater as the moisture content of the seed was increased.

A more extensive study of seed moisture and susceptibility of trefoil seeds to heating damage was conducted in the third experiment. Seeds equilibrated at 5 moisture levels, 7, 11, 14, 20 and 28% were incubated at 40, 50 and 60°C for 1 day. Seeds at 7% moisture were not susceptible to heating damage even at 60°C (Table 3). As the moisture content and temperature increased, germination decreased.

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In summary, birdsfoot trefoil seeds are very susceptible to heating injury. Exposure to temperatures as low at 40°C for 1 day are able to significantly reduce viability. Any heating which can be detected by the producer after seed storage would probably have resulted already in loss of seed quality and therefore seed drying must begin immediately after combining. The temperature experiment in table 2 emphasizes, as most producers realize, that drying must be at ambient air temperatures and that warm air drying is detrimental to seed quality. The third experiment indicates that the seed should be as dry as possible for safe storage, but it is unlikely that the seed must be dried to 7% moisture. Mold growth is inhibited at moisture contents of about 11% such that heating of seeds at this moisture level is unlikely. The removal of any green plant material before bulk storage would help to ensure that seed moisture remained low.

TABLE 1. Germination of Birdsfoot Trefoil seeds after heating for different lengths of time at 40°C.

Length of heating (days)	Moisture Content (%)		
	11	14	20
	----------Percent Germination ----------		
1	92 a*	76 b	75 b
2	87 a	39 c	7 d
3	74 b	6 d	4 d
4	71 b	3 d	3 d

* Values not followed by the same letter are significantly different at 5% level according to Duncan's multiple range test.

TABLE 2. Germination of Birdsfoot Trefoil seeds after heating 5 different temperatures and 3 moisture levels for 24 hours.

Temperature (C)	Moisture Content (%)		
	12	14	20
	----------Percent Germination----------		
30	98 a*	93 a	95 a
40	86 a	72 b	61 bc
50	56 c	5 d	4 d
60	13 d	8 d	3 d
70	3 d	3 d	2 d

* Values not followed by the same letter are significantly different at the 5% level according to Duncan's multiple range test.

TABLE 3. Germination of Birdsfoot Trefoil seeds after heating at 5 moisture levels and 3 temperatures for 24 hours.

Moisture Level	Temperature (C) 40	50	60
	Percent Germination		
7	94 a*	92 a	94 a
11	91 a	59 bc	25 de
14	76 ab	11 e	6 e
20	57 bc	8 e	2 e
28	47 cd	2 e	4 e

* Values not followed by the same letter are signicantly different at 5% level according to Duncan's multiple range test.

Hectares Inspected for Pedigreed Status in Canada*

Cultivar	1978	1979	1980	%
Cree	--	14	14	0.78
Empire	594	738	806	44.65
Leo	722	589	650	36.01
Mirabel	16	40	44	2.44
Viking	304	274	291	16.12
TOTAL:	1,636	1,655	1,805	

*1981 Final Seed Crop Report., Agriculture Canada