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The Effects of Early Harvest and Artificial Drying on Mold Deterioration and Quality of Canning Pea Seed

Richard W. Fields
University of Minnesota, St. Paul

T. H. King
University of Minnesota, St. Paul

The Effects of Early Harvest and Artificial Drying on Mold Deterioration and Quality of Canning Pea Seed [1]

RICHARD W. FIELDS and T. H. KING[2]
University of Minnesota, St. Paul

ABSTRACT: Pea seed that was field dried and exposed to two 0.5 inch rain showers had a higher percentage of seed with loose seed coats (39%) than seed that was harvested and artificially dried (3%). Also, the lots of field-dried seed were infected in the field with storage fungi (*Aspergillus spp.* and *Penicillium spp.*), while the artifically dried seed did not become infected with storage fungi prior to harvest. There was a higher percentage of abnormal seed (cracked, split, and loose seed coats) when peas were harvested at the higher moisture contents. Seed harvested at 45, 32, and 24% moisture content had a total percentage of abnormal seed of 25, 20, and 18% respectively. Temperature of drying appeared to have had an effect on the percentage of cracked seed that was harvested at 45% moisture content. Seed harvested at 45% moisture content and dried at 45, 35, and 30° C. had a total percentage of cracked seed of 25, 21, and 19, respectively, while percentage of cracked seed in lots harvested at 32 and 24% moisture content was not influenced by drying temperature. The results show that temperature of drying affects seed harvested at high moisture contents more than seed harvested at low moisture contents.

INTRODUCTION: The quality of pea seed, as indicated by germination and vigor, is influenced by such factors as the percentage of cracked, split, and loose seed coats, which are caused mainly by rapid or excessive drying or mechanical injury (2, 3, 4). Loss in germination and vigor can also be caused by bacteria (7), and fungi, such as Ascochyta, Botrytis, Fusarium, Helminthosporium, Ophiobolus, Phoma, Rhizoctonia, and Sclerotinia (5, 6, 7). Seed cracks could be a major factor for the entrance of these microorganisms into the seed. Also, species of Aspergillus cause a reduction in germination of pea seed in storage (3).

This study was undertaken to determine if by early harvesting and artificial drying the quality of pea seed grown in the midwest could be improved compared to the common practice of field drying. The effects of harvesting at various moisture contents and temperatures of drying were also studied.

MATERIALS AND METHODS: Seed of Wasatch peas grown at Spring Valley, Minnesota in 1958, was used to plant 6 plots each 14 feet wide and 165 feet long at the research plots of Libby, McNeill & Libby. At harvest time the plants and seed were handled as follows:

Plot 1. Cut and windrowed at 45% moisture – vined immediately – seed taken to laboratory for artificial drying.

Plot 2. Cut and windrowed at 45% moisture content – allowed to dry in field to about 13% moisture content – vined and seed taken to laboratory.

Plot 3. Cut and windrowed at 32% moisture content – vined immediately – seed taken to laboratory for artificial drying.

Plot 4. Cut and windrowed at 32% moisture content – allowed to dry in field to about 14% moisture content – vined and seed taken to laboratory.

Plot 5. Cut and windrowed at 24% moisture content – vined immediately – seed taken to laboratory for artificial drying.

Plot 6. Cut and windrowed at 24% moisture content – allowed to dry in field to about 15% moisture content – vined and seed taken to laboratory.

The moisture content of the seed at the time of harvest was determined by research personnel of Libby, McNeill & Libby at Spring Valley, Minnesota by the Brown-Duvel method (1). The seed was artificially dried in forced air electric ovens at 35° and 45° C. Seed was also dried in shallow pans (at about 30° C) using a fan to circulate air over and through the seed. All seed lots were artificially dried to a moisture content of approximately 10%.

Percentages of cracked seed were determined by examining under a 10X stereoscopic microscope 300 individual seeds, taken at random from each lot. If any small unnatural opening in the seed coat was observed, the seed was considered to be cracked. The seed coat was considered to be split if the opening in the seed coat was large enough to expose the cotyledons to the naked eye.

The percentage of loose-coated sed was determined by rolling 300 individual seeds from each lot between the thumb and index finger. By this method it was possible to determine if any portion of the seed coat had been separated from the cotyledons.

The percentage germination of the seed was determined by placing 50 to 100 seeds between moist paper towels, wrapping in wax paper and incubating 6 days at room temperature. Seed germination was considered nor-

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[2] Respectively, Research Assistant and Professor, Department of Plant Pathology and Botany, University of Minnesota, St. Paul 1, Minnesota. In cooperation with Libby, McNeill & Libby, Inc., Blue Island, Illinois.

mal if the root system and epicotyl were well developed.

The percentage of seeds infected with various species of Aspergillus was determined by shaking 50-100 seeds in a 1% solution of sodium hypochlorite for 1½-2 minutes and placing them on a medium containing 7½% salt, 1½% malt, and 1½% agar and incubating at room temperature 7-10 days. The fungi that grew out of the seed were then identified.

RESULTS: The percentage of damaged seed (cracked, split, loose seed coats) of the 3 lots of seed that were harvested at 45%, 32%, 24%, moisture content and artificially and field dried is presented in Table 1. The results indicate that the moisture content of seed at harvest has an influence on quality of seed, as seed harvested at 45, 32, and 24% moisture content and artificially dried had an average of abnormal seed of 25, 20, and 18%, respectively. The percentage of cracked seed was largely responsible for the amount of abnormal seed (Fig. 1). There was no apparent influence of drying temperature on the percentage of cracked seed that was harvested at 32 and 24% moisture content, but the seed harvested at 45% moisture content and artificially dried at 45° C had a higher percentage of cracked seed (25%) than any of the other lots. The percentage of seed with loose seed coats was much greater in the field dried seed than the seed that was artificially dried. The peas that were cut at 45%, 32%, and 24% moisture content and left in the field to dry had 28%, 39%, and 51% loose seed coats, respectively, compared to less than 3% for the seed that was artificially dried. The increase in the number of loose seed coats in the seed from the plants that had been left in the field to dry in windrows may have been caused by the two 0.5 inch rains that occurred during the time the seed was drying in the windrows. No apparent difference in the percentage of split seed between any of the seed lots was found.

TABLE 1. The effect of field and artificial drying on the percentage of abnormal seed prior to storage.[1]

Moisture content at harvest	Drying conditions	Seed			
		Cracked %	Split %	Loose seed coats %	Total abnormal seed %
24%	Artificially dried				
	at 45°C.	15	4	1	20
	35°C.	10	3	1	14
	30°C.	16	3	0	19
				Average	18
	Field dried	12	3	51	66
32%	Artificially dried				
	at 45°C.	16	3	3	22
	35°C.	12	5	0	17
	30°C.	15	6	0	21
				Average	20
	Field dried	16	3	39	58
45%	Artificially dried				
	at 45°C.	25	4	1	30
	35°C.	21	3	0	24
	30°C.	14	6	0	20
				Average	25
	Field dried	19	4	28	57

[1]Based on 3 replications, 100 seeds per replicate.

Table 2 presents the comparison of the number and kinds of fungi isolated from the seed that was artificially and field dried. In the three artificially dried seed lots, none of the seed was infected with storage fungi, *Aspergillus spp.* and *Penicillium spp.* The seed lots from the plants cut at 24%, 32%, and 45% moisture content and left in the field to dry were infected with storage fungi 24%, 22%, and 3%, respectively. There was also a higher percentage of *Alternaria spp.* infecting the field dried seeds. Infection with *Fusarium spp.* was no higher than 2% for either the field or artificially dried seed. There was only a slight difference in the percentage germination of the seed lots. The germination ranged from 96 to 98%, the lowest germination occurred in the seed lot harvested at 45% moisture content.

TABLE 2. Microorganisms isolated from artificially- and field-dried pea seed.[1]

Moisture content at harvest	Method of Drying	*Aspergillus amstelodami* %	*A. ruber* %	*Penicillium sp.* %	*Alternaria sp.* %	*Fusarium sp.* %
24%	Artificial	0	0	0	11	2
	Field	15	8	1	17	1
32%	Artificial	0	0	0	9	2
	Field	14	5	3	11	2
45%	Artificial	0	0	0	7	2
	Field	3	0	0	18	1

[1]Based on 200 seeds per sample for two replications.

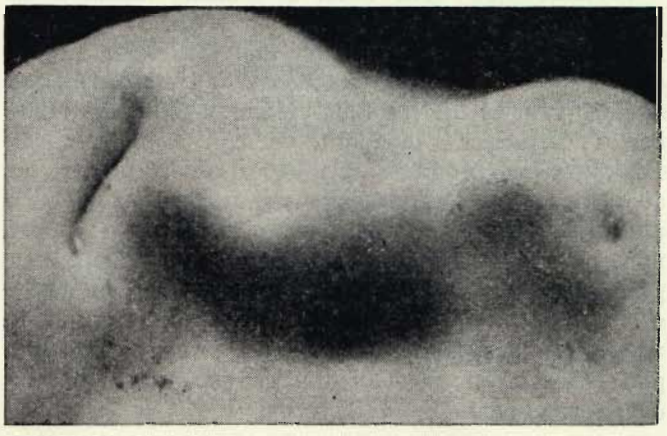

FIGURE 1. Type of micro-cracks in seed that generally cannot be distinguished with the naked eye (10X).

DISCUSSION: This study has demonstrated the importance of early harvest and artificial drying of pea seed grown in the midwest. By this method it is possible to obtain seed of high quality. The advantages of artificial drying as compared to field drying is that the peas are harvested and taken out of the field before being exposed to environmental conditions that could cause a reduction in seed quality, such as a decrease in germination, a greater amount of infection by storage fungi and other microorganisms, and an increase in the percentage of cracked, split and loose seed coats which may adversely affect the seed.

This study shows that seed should not be harvested above approximately 35% moisture content, as there is an increase in the percentage of abnormal seed, and that the temperature of drying is not too critical so long as the temperature is not high enough to injure the seed. No adverse effects were found when seed was dried at temperatures of up to 45° C.

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BOTANY

The Rate of Disappearance of Some Induced Chromosome Aberrations in the Germinating Seeds of Jack Pine[1]

RICHARD J. McMAHAN *

University of Minnesota, St. Paul

INTRODUCTION: The effect of ionizing radiation on plant material can be measured in several ways. One method makes use of the fact that irradiation causes chromosome aberrations which can be observed in the dividing cells of the resulting seedlings. Since the number of aberrations is thought to decrease as the germination of the seed progresses, cytological observations made at different stages of development are likely to render different results. The purpose of this study was to determine the rate at which induced aberrations disappear in germinating jack pine seed. This would aid in the determination of the best time to make cytological examinations when comparing the radiosensitivity of different pine seeds or the effect of different pre- and post-irradiation treatments given the seeds.

MATERIALS AND METHODS: Jack pine seed was collected for this study on Nov. 18, 1961 from several trees in a plantation about thirty years old in the Carlos Avery Game Refuge, about thirty-five miles north of St. Paul. On Nov. 21, 1961 the seed was given an X-ray dosage of 800r over a period of 45 minutes. The water content of the seed at the time of irradiation was 7.3%. Two hours after the irradiation treatment the seeds were spread on flats of fine, clean sand in a greenhouse and watered. The seeds were not covered with sand; however, a polyethylene cover kept a constant high humidity in the flats. Natural light was supplemented by two 300 watt incandescent light bulbs providing about 85 foot-candles of light to the surface of the flats. This light supplement resulted in an 18 hour day. The temperature was controlled in the greenhouse and did not fall below 70 or rise above 85°. F.

Each day following sowing, at the same hour, a sample of seeds (5 from the control and 10 from the irradiated group) was taken from the flats and the embryo tips or radicle tips, depending on the stage of development, were examined cytologically for chromosome aberrations. The following procedure was used in preparing the samples for examination. The tips were fixed in 3:1 aceto-alcohol for two hours and then hydrolized in 1N HCl at 60° C. for 15 minutes. The tips were then washed in water and stained in standard aceto-carmine for 2 to 5 minutes.

RESULTS AND DISCUSSION: Detectable embryo enlargement, cell division, and germination began five days after the seeds were sown, in both the irradiated seed and the control. The appearance of a radicle was considered evidence of germination of the jack pine seed. Non-irradiated seed showed 77% germination while irradiated seed showed only 58%. Cell divison occurred in the embryo tips at or before the time of noticeable embryo enlargement. Chromosome aberrations were recorded as the percent of cells in division containing obvious chromosome

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* The editor reports with regret Mr. McMahan's death on August 11, 1962.