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VIABILITY TESTS OF SEEDS OF DIFFERENT AGES

CHARLOTTE M. KING

Studies of longevity of seeds, of dormant period, and of vitality after subjection to certain conditions, have been made by numerous investigators, with many kinds of seeds. These all contribute to the understanding of changes which take place in the development of the seed, and of conditions necessary for growth. Such determinations have definite application to scientific agriculture. There may be called to notice results of a few notable studies of germination conditions of seeds. Dr. Candolle¹ found certain seeds of Malvaceae, Leguminosae and Labiate to be germinable after having been kept dry for fifteen years. Beal² found that various seeds, after having been buried for twenty-five years, grew; among these were *Amaranthus retroflexus*, *Brassica nigra*, *Capsella Bursa-pastoris*, *Lepidium virginicum*, *Oenothera biennis*, *Polygonum Hydropiper*, *Portulaca oleracca*, and *Rumex crispus*. Dr. L. H. Pammel³ determined, in experiments with a large number of kinds of weed seeds, that in general they germinate better after freezing and out-of-door conditions of wintering than when held over winter in dry storage.

In a study of resistance of seeds of soft maple to drying, and to low temperature, Dr. Pammel⁴ found that vitality of the seeds was diminished by both induced conditions.

The literature is extensive, and includes investigations in physiology and cytology of seeds. The reasons for seed behavior in germination are being made the object of extensive research.

The study here presented gives results of a long term germination test with 76 kinds of seeds.

The families in which were found the seeds of longest vitality are: *Polygonaceae*, *Labiatae*, *Malvaceae*, *Leguminosae*, and *Rosaceae*.

Seeds of 76 species, including some cultivated plants, were collected in the fall of 1911 for use in a long term germination

¹ Sur la Durrce relative de la faculte of germer. Ann. Sci. Nat. III, 6-373. 1846. Physiologie vegetale 2: 618.

² Proc. Soc. Prom. Agric. Sci. 26: 89. 1905.

³ Delayed Germination. Proc. Ia. Acad. Sci. 17: 20-33.

⁴ Ibid.

test. There were prepared 20 sets of each kind of seeds, with 50 seeds in each set, except that in the case of cockleburs, 25 burs were used.

Set 1 was planted in the fall of 1911, soon after collection of the seeds.

Set 2 was kept in the laboratory and planted in the spring of 1922.

Set 3 was wintered out of doors, at the surface of the ground, and planted in the spring of 1912.

The remaining 17 sets were placed in jars at the time of collecting (fall of 1911), with each kind of seed with sand in a separate vial. These jars were deposited four feet below the surface of the cellar floor of Central Building, Iowa State College. The conditions of warmth and moisture in that location were determined to be quite comparable at the given depth to the conditions outside of the building.

One set was removed, and tried out in the greenhouse for germination in March of each of the following seasons from 1913 to 1922 inclusive. The remaining sets await future removal from the place of deposit, the intention being that germination tests shall be made in 1927, 1932, 1937, 1942, 1952, and 1962, thus completing the experiment.

Some unavoidable losses occurred during the handling and growing of the seeds, for mice were a serious interference, and in transferring and watering seeds were sometimes lost.

The results therefore are indicative rather than absolute, as to full power of viability of the seeds. More perfect control of growing conditions would have given higher germination results in cases of many seeds.

The following kinds of seeds, being a large proportion of those planted, give higher percentage of germination after a winter's ripening period than upon immediate planting after collection. Shoofly, marsh elder, white sweet clover, catnip, evening primrose, old witch grass, wild parsnip, ribgrass, rugel's plantain, barley, blue grass, Pennsylvania smartweed, five-finger, curled dock, rye, horsemint, buffalo bur, dandelion, red clover, white clover, wheat, mullein, velvet weed, quack grass, large ragweed, prostrate pigweed, cane, milkweed, oats, spanish needles, field thistle, jimson weed, wild mustard, hemp, catalpa, lamb's quarters, wild sunflower, honey locust and coffee bean.

Peas, beans and onions did not withstand wintering out-of-doors, having rotted during the winter. There were no germina-

tions from lodge pole pine nor from jack pine. Other seeds seemed to be stimulated by the treatment. After a period of 3 years English rye was found to have germinated all its seeds in the vials remaining in the ground.

It will be seen that the following kinds of seeds showed long continuance of vitality:

Velvet weed 11 years; jimsoon weed 11 years; horse nettle 11 years; five finger 10 years; curled dock 9 years; coffee-bean 9 years; tumbling pigweed 8 years; burdock 7 years; catnip 7 years; lamb's quarters 6 years; field thistle, quackgrass, dalea, evening primrose, and green foxtail, each 5 years.

TABLE SHOWING PERCENTAGE OF SEEDS GERMINATING FOR EACH OF THE SERIES OF TESTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NAME	1911 SAME FALL AS COLLECTED	1912 STORED IN LABORATORY	1912 STRATIFIED AT SURFACE, OUT-OF-DOORS	1913 STRATIFIED BELOW SURFACE	1914 STRATIFIED BELOW SURFACE	1915 STRATIFIED BELOW SURFACE	1916 STRATIFIED BELOW SURFACE	1917 STRATIFIED BELOW SURFACE	1918 STRATIFIED BELOW SURFACE	1919 STRATIFIED BELOW SURFACE	1920 STRATIFIED BELOW SURFACE	1921 STRATIFIED BELOW SURFACE	1922 STRATIFIED BELOW SURFACE	YEARS VIABLE UNDER GIVEN CONDITIONS
<i>Abutilon Theophrasti</i> Velvet weed	18	34	6	4	—	30	12	1	20	17	15	1	14	11
<i>Agropyron repens</i> Quack grass	50	88	16	74	56	—	14	—	—	—	—	—	—	5
<i>Allium cepa</i> Onion	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ambrosia artemisiifolia</i> Small ragweed	4	4	60	—	14	—	—	—	—	—	—	—	—	3
<i>Ambrosia trifida</i> Large ragweed	—	2	26	—	—	—	—	—	—	—	—	—	—	1
<i>Amaranthus blitoides</i> Prostrate pigweed	4	10	8	—	—	—	—	—	—	—	—	—	—	1
<i>Amaranthus retroflexus</i> Tumbling pigweed	8	2	8	—	6	—	2	—	10	2	—	—	—	8
<i>Andropogon sorghum</i> Cane	2	18	92	—	—	—	—	—	—	—	—	—	—	1
<i>Arctium Lappa</i> Burdock	4	—	58	18	76	—	56	70	50	—	—	—	—	7
<i>Asclepias syriaca</i> Milkweed	—	—	26	10	42	—	—	—	—	—	—	—	—	2
<i>Asparagus officinalis</i> Asparagus	48	30	4	—	—	—	—	—	—	—	—	—	—	1

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Avena sativa</i> Oats	14	98	8	—	—	—	—	—	—	—	—	—	—	1
<i>Bidens frondosa</i> Spanish needles	—	2	32	2	—	—	—	—	—	—	—	—	—	2
<i>Brassica arvensis</i> Wild mustard	24	22	52	32	26	—	—	—	—	—	—	—	—	3
<i>Catalpa speciosa</i> Hardy catalpa	—	2	—	—	—	—	—	—	—	—	—	—	—	1
<i>Cannabis sativa</i> Hemp	16	82	100	2	—	—	—	—	—	—	—	—	—	2
<i>Cardiospermum Halicacabum</i> Balloon vine	10	—	—	2	—	—	—	—	—	—	—	—	—	2
<i>Chenopodium album</i> Lamb's quarters	10	16	4	10	34	—	36	4	—	—	—	—	—	6
<i>Cirsium discolor</i> Field thistle	2	28	—	14	56	2	8	—	—	—	—	—	—	5
<i>Convolvulus sepium</i> Bindweed	2	2	1	—	—	—	—	—	—	—	—	—	—	1
<i>Dactylis glomerata</i> Orchard grass	50	14	90	14	24	—	—	—	—	—	—	—	—	3
<i>Dalea alopecuroides</i> Dalea	24	—	10	—	2	4	6	—	—	—	—	—	—	5
<i>Datura Stramonium</i> Jimson weed	2	—	46	—	29	—	78	80	—	—	70	—	14	11
<i>Daucus Carota</i> Wild carrot	34	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Digitaria sanguinalis</i> Crabgrass	—	—	—	—	6	—	—	—	—	—	—	—	—	3
<i>Euphorbia maculata</i> Spotted spurge	2	—	—	2	2	—	—	—	—	—	—	—	—	3

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NAME	1911 SAME FALL AS COLLECTED	1912 STORED IN LABORATORY	1912 STRATIFIED AT SURFACE, OUT-OF-DOORS	1913 STRATIFIED BELOW SURFACE	1914 STRATIFIED BELOW SURFACE	1915 STRATIFIED BELOW SURFACE	1916 STRATIFIED BELOW SURFACE	1917 STRATIFIED BELOW SURFACE	1918 STRATIFIED BELOW SURFACE	1919 STRATIFIED BELOW SURFACE	1920 STRATIFIED BELOW SURFACE	1921 STRATIFIED BELOW SURFACE	1922 STRATIFIED BELOW SURFACE	YEARS VIABLE UNDER GIVEN CONDITIONS
<i>Festuca pratensis</i> Meadow fescue	38	10	54	12	—	—	—	—	—	—	—	—	—	2
<i>Fraxinus lanceolata</i> Ash	—	38	30	—	6	—	4	—	—	—	—	—	—	5
<i>Gleditsia triacanthos</i> Honey locust	—	2	—	—	—	78	14	20	20	—	—	—	—	7
<i>Gymnocladus dioica</i> Coffee bean	—	6	6	—	—	—	—	—	2	2	2	—	—	9
<i>Helianthus petiolaris</i> Wild sunflower	—	54	2	—	—	—	—	—	—	—	—	—	—	1
<i>Hibiscus Trionum</i> Shoo fly	4	—	54	—	2	—	—	—	—	—	—	—	—	3
<i>Hordeum sativum</i> Barley	4	34	2	—	—	—	—	—	—	—	—	—	—	1
<i>Iva xanthifolia</i> Marsh elder	—	24	6	—	—	—	—	—	—	—	—	—	—	1
<i>Juglans nigra</i> Walnut (black)	30	30	30	20	10	—	—	—	—	—	—	—	—	3
<i>Lepidium virginicum</i> Pepper grass	28	—	—	—	6	6	—	—	—	—	—	—	—	4
<i>Lolium perenne</i> English rye	54	60	82	—	—	—	—	—	—	—	—	—	—	1

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Plantago Rugelii</i>															
Rugel's plantain		—	—	4	—	6	4	—	—	—	—	—	—	—	4
<i>Poa pratensis</i>															
Bluegrass		—	40	—	—	—	—	—	—	—	—	—	—	—	1
<i>Polygonum pennsylvanicum</i>															
Penn. smartweed		2	4	70	—	—	—	—	—	—	—	—	—	—	1
<i>Potentilla monspeliensis</i>															
Five finger		—	8	18	6	16	—	9	—	—	—	—	4	—	10
<i>Rosa pratincola</i>															
Wild rose		—	—	4	—	—	—	—	—	—	—	—	—	—	1
<i>Rumex crispus</i>															
Curled dock		8	16	52	—	68	—	27	—	—	32	20	—	—	9
<i>Salsola Kali var tenuifolia</i>															
Russian thistle		12	—	12	—	6	—	—	—	—	—	—	—	—	3
<i>Scrophularia marilandica</i>															
Simpson honey plant		4	—	6	—	—	—	—	—	—	—	—	—	—	1
<i>Secale cereale</i>															
Rye		—	48	44	4	—	—	—	—	—	—	—	—	—	2
<i>Setaria viridis</i>															
Green foxtail		22	20	54	—	68	4	4	—	—	—	—	—	—	5
<i>Solanum carolinense</i>															
Horse nettle		10	36	44	10	14	10	34	12	36	—	—	10	8	11
<i>Solanum rostratum</i>															
Buffalo bur		4	10	—	—	—	—	—	—	—	—	—	—	—	1
<i>Taraxacum officinale</i>															
Dandelion		16	38	24	—	—	—	—	—	—	—	—	—	—	1
<i>Trifolium pratense</i>															
Red clover		24	52	92	2	—	—	—	—	—	—	—	—	—	2
<i>Trifolium repens</i>															
White clover (Dutch)		—	66	96	—	—	—	—	—	—	—	—	—	—	1

VIABILITY TESTS OF SEEDS

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NAME	1911 SAME FALL AS COLLECTED	1912 STORED IN LABORATORY	1912 STRATIFIED AT SURFACE, OUT-OF-DOORS	1913 STRATIFIED BELOW SURFACE	1914 STRATIFIED BELOW SURFACE	1915 STRATIFIED BELOW SURFACE	1916 STRATIFIED BELOW SURFACE	1917 STRATIFIED BELOW SURFACE	1918 STRATIFIED BELOW SURFACE	1919 STRATIFIED BELOW SURFACE	1920 STRATIFIED BELOW SURFACE	1921 STRATIFIED BELOW SURFACE	1922 STRATIFIED BELOW SURFACE	YEARS VIABLE UNDER GIVEN CONDITIONS
<i>Triticum sativum</i> Wheat	6	92	94	—	—	—	—	—	—	—	—	—	—	1
<i>Verbascum Thapsus</i> Mullein	—	4	—	—	18	—	—	—	—	—	—	—	—	3
<i>Verbena stricta</i> Hoary Vervain	—	—	—	—	2	—	—	—	—	—	—	—	—	3
<i>Verbena urticaefolia</i> White Vervain	—	10	—	—	—	—	—	—	—	—	—	—	—	1
<i>Vicia sativa</i> Common vetch	x	50	22	—	—	—	—	—	—	—	—	—	—	1
<i>Xanthium canadense</i> Cocklebur	22	28	32	2	—	—	—	—	—	—	—	—	—	2
<i>Zea Mays</i> Corn	x	98	—	—	—	—	—	—	—	—	—	—	—	1
NUMBER OF KINDS GERMINATING EACH YEAR	44	56	55	20	30	9	12	5	8	4	5	3	3	