

1943

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John N. Martin
Iowa State College

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Recommended Citation

Martin, John N. (1943) "Germination Studies of the Seeds of Some Common Weeds," *Proceedings of the Iowa Academy of Science*, 50(1), 221-228.

Available at: <https://scholarworks.uni.edu/pias/vol50/iss1/16>

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GERMINATION STUDIES OF THE SEEDS OF SOME COMMON WEEDS

JOHN N. MARTIN

The germination of the seeds of weeds and other plants that reseed themselves is noticeably periodic. In some species the grand period of germination closely follows the rise in temperature above freezing and the thawing of the soil in the spring while in other species germination is delayed till late spring or summer, and in the case of winter annuals the seeds germinate mainly in the fall.

Some common species with seeds germinating early are the wild lettuce (*Lactuca scariola* L.), knotweed (*Polygonum aviculare* L.), curly dock (*Rumex crispus* L.), lamb's quarter (*Chenopodium album* L.), wild parsnip (*Pastinaca sativa* L.), floating foxtail (*Alopecurus geniculatus* L.), Chapman's poa (*Poa Chapmaniana*, Scribn.), wild carrot (*Daucus carota* L.), the summer cypress (*Kochia scoparia* L.), and Russian thistle (*Salsola kali*, var. *tenuifolia* G. F. W. Mey). Those species with seeds germinating later in the spring are commonly represented by the Jimson weed (*Datura stramonium* L.), sandbur (*Cenchrus Carolinianus* Walt.), cocklebur (*Xanthium canadense* L.), shoofly (*Hibiscus trionum* L.), velvet leaf or butterprint (*Abutilon theophrasti* Medic.), barnyard grass (*Echinochloa crus-galli* (L.) Beauv.), green foxtail (*Setaria viridis* (L.) Beauv.), pigeon grass (*Setaria glauca* (L.) Beauv.), whorled foxtail (*Setaria verticillata* (L.) Beauv.), pigweed or green amaranth (*Amaranthus retroflexus* L.), prostrate pigweed (*Amaranthus blitoides* (Wats)), tumble weed (*Amaranthus graecizans* L.), and crab grass (*Digitaria sanguinalis* (L.) scop.)

The mustards of which the shepherd's purse *Capsella bursa-pastoris* L.), and pepper grasses (*Lepidium apetalum* L. and *virginicum* L.), and tumble mustard (*Sisymbrium altissimum* L.) are common representatives, and the squirrel tail grass (*Sitanion hystrix* L.), and the downy brome grass (*Bromus tectorum* L.) are species with seeds of which many germinate in the fall.

The plants that get started in the fall must be exceptionally hardy in the early stages of development for they run the hazard of being killed by the winter temperatures. The species with seeds that germinate early in the season have a long period in which to develop and mature seeds but on cultivated ground they are greatly in danger of destruction in their early stages of development by the preparation of the land for crops. Those that start their growth in late spring or summer as the Amaranths, barnyard grass, and foxtails, which delay their germination until after most of the preparation of the ground for planting to crops is over have better going and commonly make a good showing in the corn and soybean fields in the fall.

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The loss caused by the more common weeds, such as the foxtails and pigweeds, which are annuals but so generally prevalent on cultivated ground in the corn belt that they exact some loss from practically every type of cultivated crop, justifies an increased effort to control them. Like the weeds regarded as noxious, nearly all of the annual weeds have been introduced from other countries, many from Europe, some from Mexico and some from the tropics or elsewhere, and generally through the use of impure agricultural seed. Through neglect to prevent their seeding, cultivated soils have become thoroughly fouled with their seeds which will serve for years as sources of repeated infestations. Thus only by 100 per cent clean cultivation over a period of years, the length of the period unknown but no doubt variable for the different species, can these weeds be eliminated. Any effort, however, that reduces the infestations will pay well in better crops. The infestations are most easily destroyed in the seedling stage for which reason it is of some importance to know the germinating periods of the seeds of the different species.

Over a period of years the germination of the seeds of a number of the common weeds have been observed on some of the experimental plots at the Iowa Experiment Station at Ames and germination data recorded as shown in Table I.

TABLE I: THE DATES AT WHICH THE SEEDS OF THE DIFFERENT SPECIES WERE OBSERVED TO BEGIN GERMINATING IN THE FIELD.

| SCIENTIFIC NAME | COMMON NAME | 1934 | 1935 | 1936 | 1937 | 1941 | 1942 |
|--|------------------------------------|-------|--------------|----------|-------|---------------|-------|
| <i>Amaranthus biitoides</i> | prostrate pigweed | 5-4 | 4-15 | 4-12 | ..... | 5-10 | 4-10 |
| <i>Amaranthus graecizans</i> | tumble weed | 5-1 | 4-15 | 4-12 | ..... | 5-10 | 4-10 |
| <i>Amaranthus retroflexus</i> | pigweed-green amaranth | 5-1 | 4-15 | 4-12 | ..... | 5-10 | 4-10 |
| <i>Ambrosia artemisiifolia</i> | small ragweed . . . . . | ..... | 4-10 | 4-5 | ..... | ..... | 4-1 |
| <i>Ambrosia trifida</i> | great ragweed . . . . . | ..... | 4-10 | 4-5 | ..... | ..... | 4-1 |
| <i>Abutilon theophrasti</i> | velvet leaf butter print | 5-20 | 5-21 | 5-5 | 5-9 | 6-1 | 5-1 |
| <i>Arctium lappa</i> | great burdock . . . . . | ..... | 4-24 | 4-10 | 4-20 | ..... | 4-1 |
| <i>Alopecurus geniculatus</i> | floating foxtail . . . . . | ..... | ..... | ..... | ..... | 4-1 | 3-28 |
| <i>Bromus tectorum</i> | downy brome | 8 | (9) (10) | ..... | ..... | (9) (10) | ..... |
| | | | (4) | | | | |
| <i>Capsella bursa-pastoris</i> | Shepherd's purse | 7-28 | ..... | 8-20 | 7-16 | 7-11 | ..... |
| <i>Cenchrus carolinianus</i> | sandbur | 5-8 | 5-25 | 5-15 | ..... | ..... | ..... |
| <i>Chenopodium album</i> | lamb's quarters | 4-1 | 4-1 | 3-20 | ..... | 4-1 | ..... |
| <i>Daucus corota</i> | wild carrot . . . . . | ..... | ..... | 4-25 | ..... | (9) (10) | 3-30 |
| | | | | | | (4) | |
| <i>Datura stramonium</i> | jimson weed . . . . . | ..... | 5-15 | 5-10 | 5-15 | 4-20 | 4-4 |
| <i>Echinochloa crus-galli</i> | barnyard grass . . . . . | ..... | 5-15 | 5-10 | 5-14 | ..... | 5-3 |
| <i>Sitanion hystriz</i> | squirreltail grass . . . . . | ..... | ..... | (9) (10) | ..... | ..... | ..... |
| | | | | (4) | | | |
| <i>Kochia scaparia</i> | summer cypress . . . . . | ..... | 3-1 | 2-28 | ..... | 4-1 | ..... |
| <i>Lactuca scariola</i> | wild lettuce | 3-5 | 3-8 | 3-1 | ..... | 4-1 | 3-18 |
| <i>Pastinaca sativa</i> | wild parsnip | 4-1 | 4-1 | 3-25 | ..... | ..... | 3-22 |
| <i>Poa chapmaniana</i> | Chapman's poa . . . . . | ..... | ..... | ..... | 4-6 | 4-1 | 3-29 |
| <i>Polygonum aviculare</i> | knotweed | 3-12 | 3-10 | ..... | ..... | ..... | 3-17 |
| <i>Salsola kali</i> var. <i>tenuifolia</i> | Russian thistle . . . . . | ..... | 3-15 | ..... | ..... | ..... | 3-28 |
| <i>Setaria glauca</i> | foxtail pigwegrass | 5-4 | 5-4 | 4-25 | 5-1 | 5-20 | 5-2 |
| <i>Setaria viridis</i> | green foxtail | 5-4 | 5-4 | 4-25 | 5-1 | 5-20 | 5-2 |
| <i>Setaria verticillata</i> | whorled foxtail | 5-4 | 5-4 | 4-25 | 5-1 | 5-20 | 5-2 |
| <i>Solanum rostratum</i> | buffalo bur . . . . . | ..... | 5-25 | 5-15 | 5-15 | 5-20 | 5-4 |
| <i>Verbena hastata</i> | blue vervain | 4-5 | 4-1 | 4-10 | ..... | ..... | 5-1 |
| <i>Xanthium canadense</i> | Cocklebur . . . . . | ..... | ..... | ..... | 5-1 | 5-2 | 4-22 |
| <i>Rumex crispus</i> | Curly dock . . . . . | ..... | 4-1 | 3-25 | ..... | 4-10 | 4-5 |
| <i>Hibiscus tarionum</i> | shoofly . . . . . | ..... | ..... | ..... | 5-9 | 5-15 | 5-5 |
| <i>Digitaria sanguinalis</i> | crab grass . . . . . | ..... | ..... | 5-15 | ..... | 5-20 | 5-15 |
| <i>Rumex acetosella</i> | Red sorrel . . . . . | ..... | ..... | ..... | ..... | 4-10 | 3-28 |
| <i>Sonchus arvensis</i> | corn sow thistle . . . . . | ..... | ..... | ..... | ..... | 4-1 | 4-2 |
| <i>Bromus secalinus</i> | chess . . . . . | ..... | 7-24 Oct. | ..... | ..... | Sept. Oct. | ..... |
| <i>Erigeron philadelphicus</i> | stink grass . . . . . | ..... | ..... | 5-26 | ..... | April 5-20 | ..... |
| <i>Sisymbrium officinalis</i> | tumble mustard | 4-15 | ..... | ..... | 4-4 | 4-1 | ..... |

As shown in Table I, the germinating period of the early germinating seeds varies considerably with the conditions for growth of the different seasons.

The data in Table I pertain only to the initiatory stage of the germination period which is widely variable in length for the different species. Species with very short periods of seed germination are represented by Chapman's poa and floating foxtail. The germination period of their seeds is pretty well restricted to March and April. Similarly the germinating period of the seeds of the lamb's quarter, ragweed's, wild parsnip, curly dock, and wild lettuce end

TABLE II: GERMINATION OF SOME WEED SEEDS AT DIFFERENT TEMPERATURES WITH SEED COATS INTACT AND PARTIALLY OR WHOLLY REMOVED. TEST MADE SOON AFTER HARVEST.

| SPECIES | Seeds untreated | | | | | Seed coat entirely or partially removed | | | | |
|---|-----------------|-------------|-------------|-------------|-------------|---|-------------|-------------|-------------|--------------|
| | Germination at— | | | | | Germination at— | | | | |
| | 15° | 20° | 25° | 30° | 35° | 15° | 20° | 25° | 30° | 35° |
| <i>Abutilon</i> (range) <i>theophrasti</i> (velvet leaf) (Av.) | 4-26 15 | 10-28 18 | 12-22 18 | 8-20 14 | 10-36 25 | | | | 62-76 69 | |
| <i>Amaranthus blitoides</i> (creeping pigweed) | | | 0 | | | | | 33 | | |
| <i>Amaranthus graecirans</i> (tumble weed) | 0 | 0-2 1 | 2-24 11 | 0-60 27 | 48-84 59 | 18-38 28 | 17-58 38 | 57-88 76 | 30-88 64 | 59-96 78 |
| <i>Ambrosia artemisiifolia</i> (small ragweed) | 0 | 0 0 | 0 | 0 | 0 | 14 | 14 | 46 | 47 | 48 |
| <i>Ambrosia trifida</i> (large ragweed) | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 60 | 64 | 55 |
| <i>Chenopodium album</i> (lamb's quarter) | 10-20 17- | 18-35 24 | 16-64 28 | 10-60 23 | 4-34 19 | 70-95 82 | 92-96 94 | 96-98 97 | 96-98 97 | 94-100 97 |
| <i>Daucus carota</i> (wild carrot) | 26-30 28 | 48-58 53 | 28-78 59 | 24-86 55 | 0-76 53 | | | | | |
| <i>Datura stromonium</i> (jimson weed) | | | 33 | | | | | 100 | | |
| <i>Digitaria sanguinalis</i> (crab grass) | | 0 | 2 | 0-18 8 | 12-24 18 | 8 | 27 | 29 | 29 | 37 |
| <i>Echinochloa crus-galli</i> (barnyard grass) | | | 0 | | | | | 50 | | |
| <i>Hibiscus trionum</i> (shoofly) | 8 | 8-10 9 | 4-15 12 | 4-19 12 | 4-8 7 | | | | 46-80 63 | |
| <i>Panicum capillare</i> (witch grass) | | | 2-8 5 | 0-92 39 | 42-97 89 | | | 32-84 56 | 32-80 52 | 48-52 50 |
| <i>Setaria viridis</i> (green foxtail) | | | 14-53 28 | 20-55 34 | 34-58 49 | 63 | 71 | 40-86 70 | 64-90 | 68-74 |

rather abruptly with the approach of summer temperatures. The germination of the foxtails, crabgrass, stinkgrass, cocklebur, buffalo bur, sandbur and jimson weed is confined mostly to May and June. In some species, as for example the wild carrot, the seeds germinate at various times in the season, especially during the spring and the fall.

As shown in Table II some investigations were made to determine the relation of the seed and fruit coverings and temperature to the germination of the seeds of some common weed species.

In all species except the wild carrot, the seed coat appears to be a limiting factor in the germination of the seeds. In a number of cases high temperatures tended to increase the permeability of the seed coat. The temperatures most favorable for germination in most instances ranged 20 to 30°C., either 25° or 30° being most favorable for the grasses, amaranth, velvet leaf, and jimson weed seeds, which are representative of late spring germinating species. The seeds of the wild carrot and lamb's quarter which have an early germinating period germinate at relative low temperatures.

The seeds of some of the species were investigated as to their germination after storage in a constantly low temperature, both in a dry and wet condition. As shown in Table III the seeds of most of the species do not require an exposure to alternating temperatures for good germination, but germinate well after a storage at a low constant temperature and whether kept constantly wet or constantly dry.

Table III: The percentage of germination of seeds after being stored over winter in a constantly low temperature of 5°C. The seeds were harvested before frost and stored in refrigerators until time of germination tests in early June. One lot was kept wet and the other dry.

| Scientific Name | Common Name | Percentage Germination | |
|-------------------------------|---------------------|------------------------|-----|
| | | Dry | Wet |
| <i>Abutilon theophrasti</i> | velvet weed | 95 | 92 |
| <i>Amaranthus blitoides</i> | prostrate amaranth | 0 | 0 |
| <i>Amaranthus graecizans</i> | tumble weed | 60 | 65 |
| <i>Amaranthus retroflexus</i> | pigweed | 88 | 84 |
| <i>Daucus carota</i> | wild carrot | 85 | 87 |
| <i>Digitaria sanguinalis</i> | crab grass | 2 | 5 |
| <i>Hibiscus trionum</i> | Shoofly (Cat's eye) | 24 | 10 |
| <i>Lactuca scariola</i> | wild lettuce | 98 | 94 |
| <i>Lepidium apetalum</i> | pepper grass | 90 | 89 |
| <i>Melilotus alba</i> | white sweet clover | 14 | 85 |
| <i>Pastinaca sativa</i> | wild parsnip | 90 | 95 |
| <i>Rumex crispus</i> | curly dock | 96 | 93 |
| <i>Setaria glauca</i> | smooth foxtail | 92 | 90 |
| <i>Setaria viridis</i> | green foxtail | 98 | 95 |
| <i>Solanum carolinense</i> | horse nettle | 0 | 3 |
| <i>Verbena hastata</i> | blue vervain | 0 | 2 |

TABLE IV: GERMINATION OF WEED SEEDS COLLECTED, AND STORED UNDER DIFFERENT CONDITIONS.

| Date of Germination Tests and Species | Stored 14° | | Stored Laboratory Temp. | Stored outdoors in cheesecloth bags | |
|--|-------------------|-------------------|-------------------------|-------------------------------------|-------------------|
| | Dry percent Germ. | Wet percent Germ. | Dry percent Germ. | Dry percent Germ. | Wet percent Germ. |
| <i>Abutilon theophrasti</i> (Velvet leaf) | | | | | |
| October, 1934..... | | | 7 | | |
| January, 1935..... | 95 | 62 | 1 | 53 | 54 |
| February, 1935..... | 12 | 16 | 0 | 42 | 38 |
| March, 1935..... | 64 | 40 | 0 | 56 | 44 |
| April, 1935..... | 10 | 11 | 0 | 10 | 19 |
| May, 1935..... | 0 | 0 | 0 | 6 | 9 |
| June, 1935..... | 95 | 93 | 0 | 96 | 90 |
| <i>Amaranthus blitoides</i> (creeping pigweed) | | | | | |
| October, 1934..... | | | 20 | | |
| January, 1935..... | 0 | 1 | 32 | 0 | 1 |
| February, 1935..... | 0 | 0 | 0 | 0 | (bottles)53 |
| March, 1935..... | 0 | 8 | 0 | 0 | 0 |
| April, 1935..... | 2 | 4 | 0 | 9 | 10 |
| May, 1935..... | 4 | 5 | 4 | 14 | 18 |
| June, 1935..... | 90 | 86 | 0 | 0 | 2 |
| <i>Amaranthus graecizans</i> (tumbleweed) | | | | | |
| January, 1935..... | 58 | 21 | 70 | 71 | 50 |
| February, 1935..... | 13 | 30 | 6 | 2 | 7 |
| March, 1935..... | 8 | 16 | 4 | 12 | 0 |
| April, 1935..... | 0 | 0 | 0 | 0 | 4 |
| May, 1935..... | 12 | 20 | 0 | 0 | 0 |
| June, 1935..... | 60 | 65 | 0 | 0 | 0 |
| <i>Amaranthus retroflexus</i> (pigweed) | | | | | |
| January, 1935..... | 31 | 1 | 16 | 41 | 1 |
| February, 1935..... | 5 | 4 | 10 | 8 | 0 |
| March, 1935..... | 56 | 4 | 11 | 72 | 0 |
| April, 1935..... | 4 | 0 | 6 | 4 | 1 |
| May, 1935..... | 0 | 0 | 8 | 0 | 0 |
| June, 1935..... | 88 | 84 | 10 | 20 | 0 |
| <i>Chenopodium album</i> (Lamb's quarters) | | | | | |
| October, 1934..... | 8 | 5 | 6 | 6 | 7 |
| November, 1934..... | 3 | 1 | 6 | 4 | 2 |
| December, 1934..... | 0 | 0 | 8 | 3 | 4 |
| January, 1935..... | 0 | 0 | 0 | 7 | 0 |
| February, 1935..... | 2 | 4 | 0 | 2 | 3 |
| March, 1935..... | 9 | 10 | 2 | 6 | 8 |
| April, 1935..... | 11 | 13 | 1 | 10 | 14 |
| May, 1935..... | 7 | 4 | 0 | 6 | 9 |
| June, 1935..... | 0 | 0 | 0 | 3 | 5 |
| <i>Daucus carota</i> (Wild Carrot) | | | | | |
| October, 1934..... | | | 71 | | |
| January, 1935..... | 46 | 78 | 65 | 79 | 31 |
| February, 1935..... | 40 | 39 | 25 | 32 | 37 |
| March, 1935..... | 52 | 72 | 0 | 16 | 7 |
| April, 1935..... | 9 | 10 | 0 | 0 | 0 |
| May, 1935..... | 0 | 0 | 0 | 0 | 0 |
| June, 1935..... | 85 | 88 | 0 | 62 | 66 |

TABLE IV: GERMINATION OF WEED SEEDS COLLECTED, AND STORED UNDER DIFFERENT CONDITIONS—Continued

| Date of Germination Tests and Species | Stored 14° | | Stored Laboratory Temp. | Stored outdoors in cheesecloth bags | |
|---|-------------------|-------------------|-------------------------|-------------------------------------|-------------------|
| | Dry percent Germ. | Wet percent Germ. | Dry percent Germ. | Dry percent Germ. | Wet percent Germ. |
| <i>Digitaria sanguinalis</i> (goosegrass) | | | | | |
| January, 1935 | 1 | 0 | 2 | 0 | 0 |
| February, 1935 | 22 | 7 | 0 | 1 | 0 |
| March, 1935 | 44 | 68 | 1 | 4 | 0 |
| April, 1935 | 4 | 0 | 0 | 0 | 0 |
| May, 1935 | 8 | 4 | 0 | 0 | 0 |
| June, 1935 | 2 | 5 | 0 | 0 | 0 |
| <i>Hibiscus trionum</i> (shoofly) | | | | | |
| November, 1934 | | | 2 | | |
| December, 1934 | | | 10 | | |
| January, 1935 | 1 | 0 | 2 | 0 | 0 |
| February, 1935 | 3 | 0 | 0 | 2 | 6 |
| March, 1935 | 16 | 0 | 1 | 8 | 0 |
| April, 1935 | 4 | 0 | 0 | 0 | 0 |
| May, 1935 | 2 | 0 | 0 | 0 | 0 |
| June, 1935 | 24 | 10 | 0 | 2 | 0 |
| <i>Lactuca scariola</i> (wild lettuce) | | | | | |
| August, 1935 | | | | | |
| January, 1935 | 74 | 75 | 45 | 45 | 41 |
| February, 1935 | 0 | 0 | 34 | 4 | 5 |
| March, 1935 | 14 | 0 | 12 | 24 | 24 |
| April, 1935 | 0 | 0 | 4 | 8 | 16 |
| May, 1935 | 0 | 0 | 0 | 0 | 12 |
| June, 1935 | 98 | 94 | 2 | 90 | 88 |
| <i>Lepidium apetalum</i> (pepper grass) | | | | | |
| December, 1934 | | | 26 | | |
| January, 1935 | 49 | 72 | 21 | 78 | 36 |
| February, 1935 | 7 | 0 | 0 | 8 | 4 |
| March, 1935 | 36 | 0 | 0 | 16 | 2 |
| April, 1935 | 26 | 20 | 0 | 0 | 0 |
| May, 1935 | 32 | 20 | 0 | 0 | 0 |
| June, 1935 | 90 | 89 | 0 | 98 | 96 |
| <i>Pastinaca sativa</i> (wild parsnip) | | | | | |
| At collection | | | 7 | | |
| January, 1935 | 9 | 20 | 38 | 0 | 0 |
| February, 1935 | 0 | 0 | 26 | 0 | 0 |
| March, 1935 | 0 | 60 | 12 | 8 | 4 |
| April, 1935 | 0 | 0 | 0 | 12 | 8 |
| May, 1935 | 0 | 0 | 5 | 0 | 0 |
| June, 1935 | 0 | 0 | 0 | 0 | 0 |
| <i>Rumex crispus</i> (curly dock) | | | | | |
| October, 1934 | | | 60 | | |
| January, 1935 | 76 | 81 | 2 | 61 | 30 |
| February, 1935 | 0 | 1 | 0 | 9 | 15 |
| March, 1935 | 32 | 36 | 0 | 68 | 36 |
| April, 1935 | 6 | 1 | 0 | 0 | 1 |
| May, 1935 | 1 | 0 | 0 | 0 | 0 |
| June, 1935 | 96 | 92 | 0 | 95 | 90 |

TABLE IV: GERMINATION OF WEED SEEDS COLLECTED, AND STORED UNDER DIFFERENT CONDITIONS—Continued

| Date of Germination Tests and Species | Stored 14° | | Stored Laboratory Temp. | Stored outdoors in cheesecloth bags | |
|---|-------------------|-------------------|-------------------------|-------------------------------------|-------------------|
| | Dry percent Germ. | Wet percent Germ. | Dry percent Germ. | Dry percent Germ. | Wet percent Germ. |
| <i>Setaria glauca</i> (foxtail) | | | | | |
| October, 1935..... | | | | | 2 |
| January, 1935..... | 9 | 10 | 16 | 24 | 36 |
| February, 1935..... | | | | | 45 |
| February, 1935..... | | | | | 5 |
| <i>Setaria viridis</i> (green foxtail) | | | | | |
| October, 1934..... | | | 2 | | |
| October, 1934..... | | | 12 | | |
| January, 1935..... | 69 | 81 | 50 | 22 | 28 |
| February, 1935..... | 35 | 46 | 4 | 2 | 3 |
| March, 1935..... | 9 | 22 | 0 | 88 | 24 |
| April, 1935..... | 10 | 6 | 0 | 6 | 10 |
| May, 1935..... | 0 | 0 | 0 | 0 | 0 |
| June, 1935..... | 98 | 95 | 98 | 99 | 96 |
| <i>Sisymbrium officinale</i> (tumble mustard) | | | | | |
| January, 1935..... | 19 | 12 | 28 | 14 | 14 |
| February, 1935..... | 10 | 11 | 0 | 11 | 8 |
| March, 1935..... | 13 | 9 | 9 | 18 | 16 |
| April, 1935..... | 9 | 4 | 10 | 13 | 16 |
| May, 1935..... | 0 | 1 | 0 | 7 | 5 |
| June, 1935..... | 3 | 0 | 0 | 0 | 4 |
| <i>Solanum carolini ense</i> (horse nettle) | | | | | |
| January, 1935..... | 0 | 3 | 18 | 0 | 0 |
| February, 1935..... | 0 | 7 | 0 | 0 | 1 |
| March, 1935..... | 0 | 0 | 0 | 0 | 0 |
| April, 1935..... | 0 | 0 | 0 | 0 | 0 |
| May, 1935..... | 0 | 0 | 0 | 0 | 0 |
| June, 1935..... | 0 | 0 | 0 | 0 | 0 |
| <i>Verbena hastata</i> (blue vervain) | | | | | |
| January, 1935..... | 0 | 25 | 12 | 0 | 5 |
| February, 1935..... | 0 | 3 | 7 | 0 | 2 |
| March, 1935..... | 0 | 12 | 3 | 0 | 12 |
| April, 1935..... | 0 | 0 | 0 | 0 | 0 |
| May, 1935..... | 0 | 0 | 0 | 0 | 0 |
| June, 1935..... | 0 | 2 | 1 | 0 | 0 |

The seeds of *Rumex crispus*, *Pastinaca sativa*, *Daucus carota*, and *Melilotus alba* in the wet samples, all early germinating species, germinated in the refrigerator before they were removed for the tests. Unlike the seeds of many cultivated plants, most of the weed seeds included in the Table III and IV apparently suffer very little if any impairment of vitality by being kept constantly wet at low temperatures. In Table IV are shown the germinations of some common weed seeds after different periods of storage under both constant and fluctuation temperatures.

The results given in Table IV again emphasize the fact that most of seeds included have no specific requirements for germination. The seeds of the velvet leaf, amaranths, wild carrot, wild lettuce, pepper grass, curly dock, and green foxtail, germinated about equally under the three types of storage. In case of the seeds of the velvet leaf, amaranths, curly dock, and green foxtail, the germinations were better at the end of the storage period in June, but in most cases the germination was fair after short periods of storage. The seeds of green foxtail, curly dock, pepper grass, velvet leaf, wild lettuce, wild carrot, and tumble weed apparently would germinate in the field during the winter months if their required germination temperatures were provided.

The seeds of the horse nettle and blue vervain are restricted in germination by requirements that were not met in any of the tests and no satisfactory germination was obtained.

SUMMARY

The seeds of the common weeds discussed in this paper are periodical in germination, some species germinating early in the spring, others in late spring or early summer, and some in the fall. Some of the early germinating species germinated in moist storage at 5°C. The seeds of all species investigated, excepting those of the horse nettle and blue vervain, require no special conditions for germination beyond suitable moisture and temperature. In most cases germination is somewhat inhibited by seed coat or fruit covering until after a short period of weathering. Various types of storage, as in constantly low, laboratory, or alternating outdoor temperatures, did not as a rule affect significantly the germination, which was good after all types of storage.

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