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Sunflower Studies

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SUMMARY.

In timothy breeding, which is a comparatively new phase of experimental agronomy, standard methods have yet to be worked out and adopted. Several methods which have recently been developed for making comparative quantitative studies of different selections or varieties of timothy are described in this paper.

Through the use of certain definitions which describe timothy plants in different stages of bloom and maturity, it has been possible to obtain accurate records of the time when the plants of different selections or varieties of timothy are in bloom and mature.

A system of counting the number of leaves with partially or entirely green blades has been developed, by which the relative numbers of green leaves, per unit of area, on different dates in broadcast plats of different kinds of timothy, can be accurately determined.

By measuring the longest stem of each plant growing in cultivated row plats of different selections or varieties of timothy, it is possible to obtain data which show not only the relative lengths of the stems of the plants in the different plats, but which also show the relative degree of uniformity in the lengths of the stems of plants in the plats in which measurements are made.

SUNFLOWER STUDIES[1]

P. V. CARDON.[2]

I — VARIATION IN THE "MAMMOTH RUSSIAN" VARIETY.

The results of cultural experiments with sunflowers, as conducted since 1915 by the Montana Experiment Station, show the "Mammoth Russian" to be better as regards acre-yield of silage than any other variety tested. However, it is plain to all observers that there is little uniformity in the type of plants produced from the commercial seed of this variety and the possibility of developing superior strains must have appealed to everyone who is interested in selection for the improvement of the sunflower crop.

In Montana, a particularly urgent need for improvement in the sunflower crop arises as the result of varied conditions of soil and climate. In the high plateau regions of the western part of the state, where sunflowers seem to be especially well adapted, no seed can be matured because of the short growing season. This condition makes necessary the importation of seed from other regions. Good sun-

[1] Contribution from Agronomy Department, Montana Agricultural Experiment Station, Bozeman, Mont. Received for publication, April 17, 1921.

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flower seed can be produced under irrigation in the lower altitudes of eastern Montana, and it may be possible to establish in that region seed supplies to meet the requirements of western Montana farmers. The problem, however, is to get a strain to satisfy both the seed grower of the east and the silage grower of the west.

The difficulty encountered in harvesting sunflowers which are so tall as they grow under irrigation in Montana, affords another practical reason for undertaking improvement work with sunflowers. A high producing strain possessing a relatively low habit of growth, which would facilitate the harvest of the crop by permitting free use of the corn binder, would be especially desirable.

It was in recognition of the foregoing requirements that the Agronomy Department of the Montana Experiment Station began its selection work with sunflowers in the spring of 1920. Although the results of only one season are available, they are suggestive of the possibilities with this crop.

For the reasons already given, the " Mammoth Russian " variety was used in this preliminary work. Identical plantings were made under irrigation at Bozeman, and on dry land at Huntley, Moccasin and Havre, each point being representative of a different combination of soil and climatic conditions. In each planting, there were 144 hills (checked) 3 feet apart, making a plot 39 feet square. Only the 100 plants inside the square were studied, the 12 outside plants on each side of the square being treated as controls. Since the 100 plants were equi-distant and all under practically the same environmental influences, it was assumed that their habits of growth were entirely the result of inherent tendencies. Seed from the same commercial lot was used at all four points, and enough seed sown in each hill to insure the presence of at least one plant. Later, only one plant was left to develop in each hill.

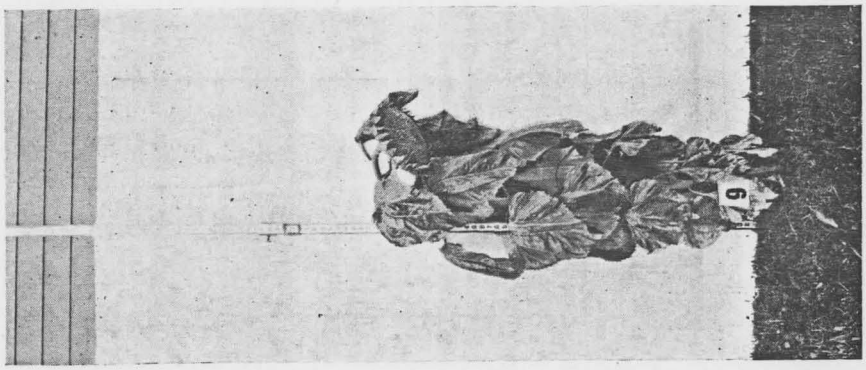
The plantings at Moccasin and Havre were seriously injured by drouth, but at Huntley and at Bozeman it was possible to make some interesting comparisons, as shown by the photographs presented herewith. [3] See Plates I, II and III.

At Huntley, on September 7, when most of the plants were in full bloom, 10 different types were distinguished. Later, it was found that two of these (No. 3 and No. 4) each comprised at least two sub-types, distinguishable on the basis of either seed color or earliness.

Following is a brief description of each type, with the percentage of plants it included, and a note as to maturity.[4]

[3] All of the photographs accompanying this article were taken by J. B. Nelson, Field Superintendent, Agronomy Department, Montana Experiment Station.

[4] The writer is indebted to A. E. Seamans, Assistant in Dry Land Agriculture, Huntley Experiment Farm, for his helpful interest in these studies.



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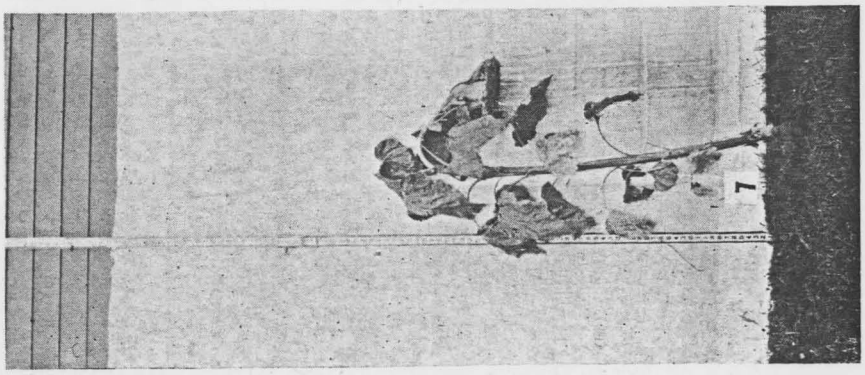

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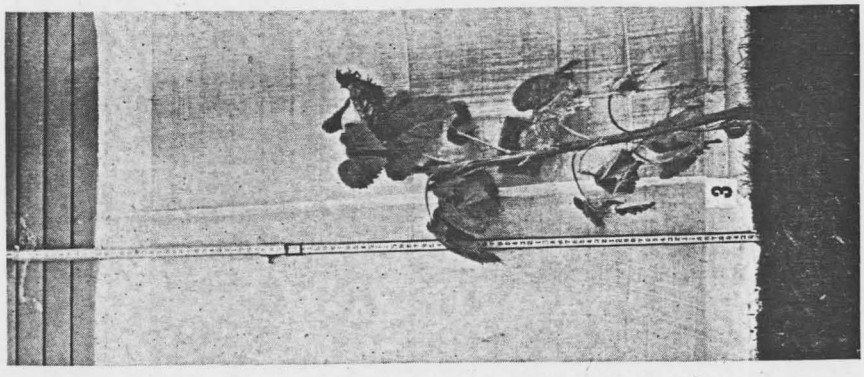

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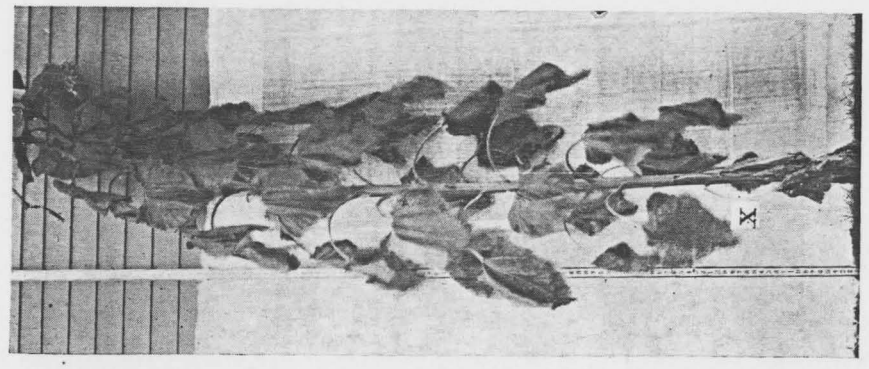

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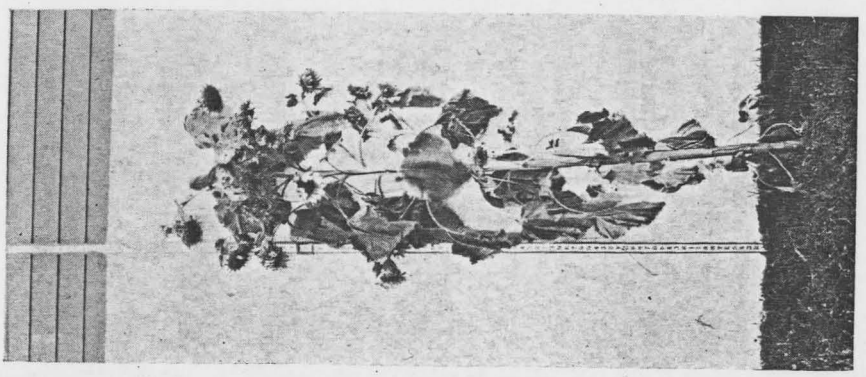

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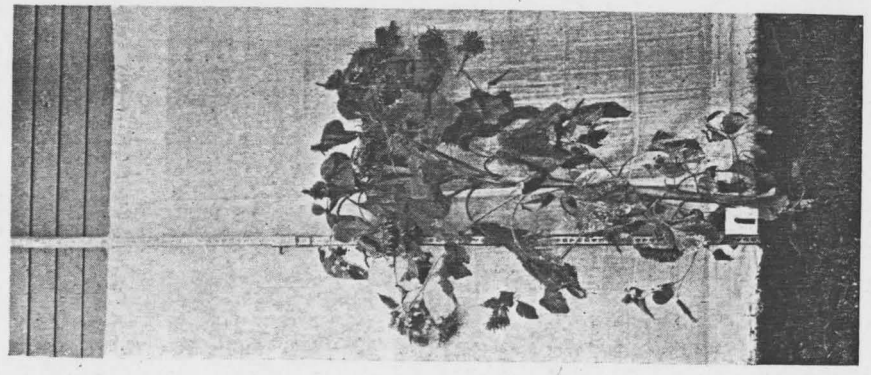

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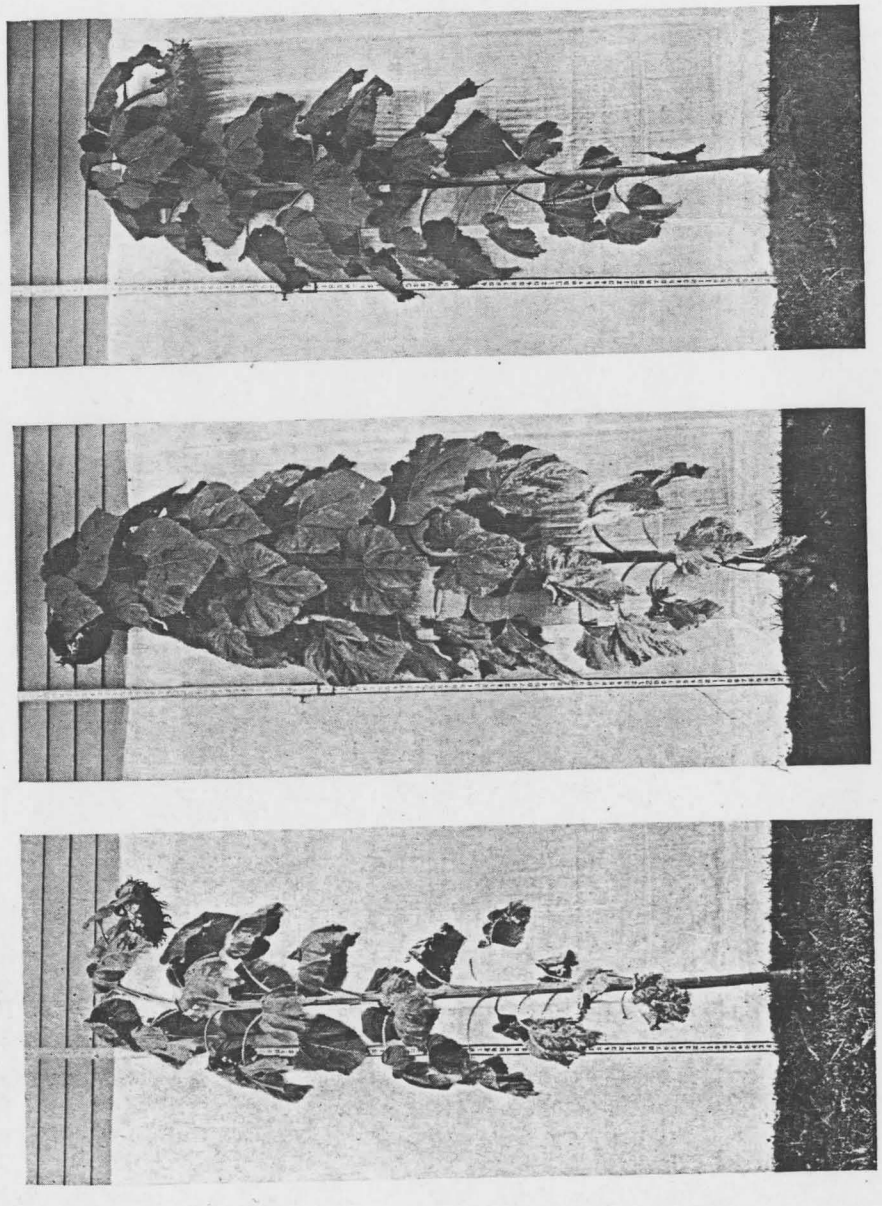

C

B

A

Type No. 1 — (6 per cent) Wild in appearance; branched, bearing heads on both primary and secondary branches; low growing and somewhat spreading; leaves mostly small, except on main stalks; stalk slender; plant light to yellowish; fully matured October 23; seeds generally small, striped to dark gray in color; (Plate II-A.)

Type No. 2 — (1 per cent) Single stalk, upright, about 6 feet tall; very broad leaves with relatively smooth margins; head of medium size with sharp crook in stem near base of head, giving "gooseneck" appearance; dark green; early maturity; seeds black with few white stripes.

Type No. 3 — (9 per cent) Very distinct type and relatively early; closely resembles No. 2, except leaves are a little smaller, sharply serated and apex more acute; about six feet tall; leaves appear to be almost in whirls on lower part of stalk; mature October 23; seed color variable (a) black with occasionally a white stripe and (b) seeds white with fine black stripes; very early, but not valuable for silage. (Plate I-A.)

Type No. 4 — (28 per cent) Tall, single stalk; unbranched; late; leaves roundly broad and deeply serated; stalk fairly thick; color variable but mostly dark green; apparently two strains; (a) matured October 23, and (b) matured November 11. (Plate III-A.)

Type No. 5 — (10 per cent) Very similar to No. 4, except for small axilary branches; seeds dark; immature November 11.

Type No. 6 — (8 per cent) Similar to No. 5, but plant is bushier and branches longer; fully matured October 23; seeds variable in color, light and dark in different heads of same plant. (Plate II-B.)

Type No. 7 — (25 per cent) Resembles No. 3, except that stalk is inclined to droop in "sickle" shape. The stem seems to taper off from about center toward head, giving appearance of long slender neck. Leaves sparse on lower part of stalk — distinct from No. 3 in this respect. Fully matured by October 23; seeds variable in both color and shape — dark to striped, and short to long; early, but foliage too sparse for high yield of silage. (Plate I-B.)

Type No. 8 — (11 per cent) Resembles No. 4, except at top. Leaves more numerous than on No. 4; shorter internodes, giving "pine top" appearance to plant; only few mature seeds found on November 11; ideal for heavy yields, but too tall for ease in harvesting. (Plate III-B.)

Type No. 9 — (1 per cent) Closely approaches No. 7, except that leaves are more numerous and much broader; plant low-growing, single stalk; stalky, with approach to "sickle" neck; no seed matured. (Plate I-C.)

Type No. 10 — (1 per cent) Tall, approaching No. 4 in height and general appearance, but has head and leaf characters of No. 3, and tapering at top of stalk similar to No. 7; no seed matured. (Plate III-C.)

Eight of the types described at Huntley were easily distinguished among the irrigated plants at Bozeman; but at the latter place No. 2 and No. 5 were not represented, whereas X, an eleventh type, was discovered. This type is extremely tall and late; it was not yet in full bloom when killed by frost.

Viable seed was secured of all the earlier types except No. 2, and will be used in connection with a continuation of these studies.

II — EFFECT OF BAGGING SUNFLOWER HEADS.

Uncertainty as to whether sunflowers are normally self-fertilized led the writer to bag a number of heads during the season of 1920 and observe their behavior. The effect of bagging on fertilization was so pronounced as to be of special interest.

The first effect to be noted was the disturbance of the normal flowering habit. Ordinarily, the flowers on the sunflower head

open in regular sequence from the periphery to the center of the head; and those in the outer circles are often withered by age before those in the center are even open. When bagged, however, all of the flowers on each head opened at about the same time. This was first observed quite by accident, after a storm had torn open one of the bags, but it was later confirmed by close examination of many different bagged heads, at Huntley as well as at Bozeman.

Another surprising result of bagging was that although the heads, and even the seeds, appeared to develop normally, practically all of the seeds were infertile. On some heads no fertile seeds could be found, whereas on others there were a few. In almost every instance, the head, in outward appearance at least, was as sound and fully developed as the unbagged heads, and every seed shell was of full size and typical color; yet there was absolutely no development of the kernel within the shell. In all cases the bags, containing an abundance of pollen, were agitated considerably by the wind — in a few instances by hand — but this made no apparent difference in the degree of fertilization which took place.

In this connection another interesting observation was made in the case of a plant bearing several heads, one of which was bagged. Every unbagged head matured normally developed seeds, whereas all the seeds of the bagged head were infertile. It is significant to note that at one time, on a single unbagged head, as many as ten insects, mostly bees, were counted.

These observations which afford convincing evidence of self-sterility in sunflowers are suggestive of the difficulties to be encountered in attempting to secure improved strains of this crop. That something more than the mere selection of heads will be necessary, is made plain by the fact that in 1920 head-rows planted from heads selected in 1919 displayed varying degrees of uniformity. In one head-row there was quite as much variation in type as was found in the plantings discussed in the first part of this article.