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## ALFALFA STUDIES

THIRD PROGRESS REPORT

BY

P. K. BLINN

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# The Agricultural Experiment Station

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# REPORT OF ALFALFA INVESTIGATIONS.

By PHILO K. BLINN.

The attempt to improve the hay and seed yielding traits of alfalfa, by systematic seed selection, has had decidedly encouraging results; although it may yet require several years of close observation to fully determine the best types for hay and seed production.

The conclusions from some of the observations, have been rather doubtful, and there are reasons for discounting the value of some of the contrasts that have appeared; for instance, the selections, for ideal leaf, and stem qualities, made the first season, during the seedling growth of the plants in the nursery, have since proven of little value, as there was a decided change in the type of foliage, when the plants took on a more rapid and succulent growth: The same result would follow, as the effect of environment, rather than heredity, for any trait that might appear; hence, the problem is to select plants that have an inherent power for the reproduction of desirable qualities; but, with nearly a hundred strains to consider, and at least a score of points of variation appearing in endless combination, this has not been an easy undertaking.

Several of the varieties tested, show contrasts of decidedly practical value, such as, *hardiness, habits of stooling, qualities of resistance, to drouth, frost and fungus diseases, leafy hay qualities and prolific seed yields*. These valuable traits are not found in any one variety, and it is difficult to say which strains, have the points of greatest utility; it is certainly obvious, that marked improvement over most of the ordinary types, of alfalfa is possible, if only seed of some of the strains tested, could be procured, which however, is difficult, as different lots of seed supposed to be the same, often prove entirely different.

It is impossible to identify the seed origin of a field of alfalfa, and it is equally difficult, to make varietal distinction, in the points that are casually observed; for with few exceptions, the same colored flowers, the same shaped leaves, and the same general type of plants, may be found in nearly all varieties, and there is often a greater range of variation in the individual plants of a single strain, than in the contrast of so called varieties.

It is difficult to judge the merits of alfalfa, growing under different conditions of soil, and cultural care; but, in a *comparative test under uniform conditions*, the *contrasts are clearly shown*, also in *nearly all varieties* it is *easy to recognize the superior qualities of some of the individual plants*; which suggests the **SINGLE PLANT** as the **UNIT for seed selection**.

The results of our nursery work with *individual plant selections* have revealed the facts, that in plants, showing desirable qualities, *some will reproduce the traits, quite uniformly true*, while

others, will breed *irregularly* the *qualities*, that were *apparently the same*; hence, *heredity* in alfalfa plants *can not be determined*, by a *cursory view*, but more by the comparison of their *performance records*.

The plan is now, to make individual selections of seed from the *most highly efficient plants*, revealing desirable traits, where ever found, in any of the varieties, and then submit them to a fair comparative test for their reproducing tendency, thus, affording an opportunity to intelligently select and increase seed of alfalfa, with known uniformity, of qualities, for testing in different sections of the state. Some of the principal qualities, that have engaged the attention in this investigation are—*Hardiness*, there are few fields of alfalfa that have not suffered from the lack of this trait, plants dying out, either from frost, drouth, soil conditions, or plant diseases. The superiority in this respect, of the Turkestan and more hardy kinds, over the Arabian, or southern variety is very marked indeed.



PLATE I. CONTRAST OF HARDINESS BETWEEN SOUND TURKESTAN AND UNSOUND ARABIAN PLANTS

The contrast between two, two year old plants, from the nursery, can readily be seen, one perfectly sound, the other with the crown nearly all rotted off, and each having grown under the same conditions, and also representing fairly the condition of the plants, in the plats from which they were taken; showing a lack



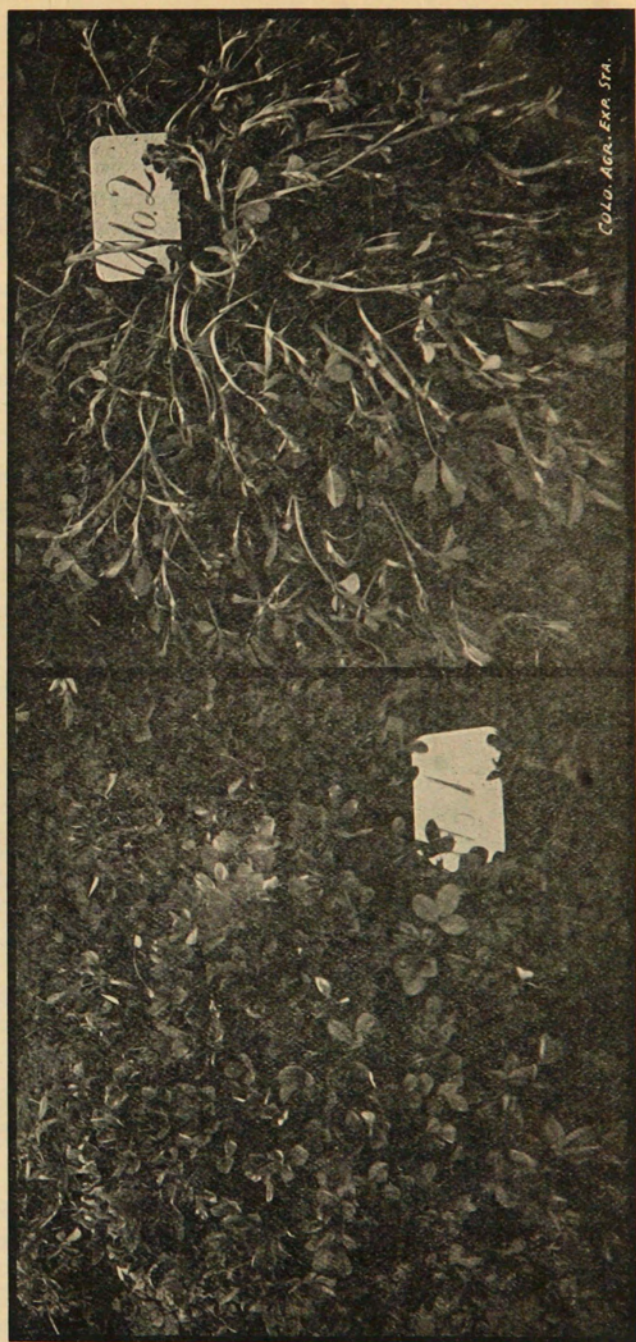


PLATE II. TWO ADJACENT TURKESTAN PLANTS, MAY 3, 1909, TWO DAYS AFTER FREEZE OF 18°  
No. 1. Dark green foliage practically uninjured.  
No. 2. Light green foliage; leaves and stems entirely frozen back. Both U. S. P. I. No. 18,425



of vitality. Another contrast along the same line, was in regard to the *frost resistance* of the *green growing plants*; on April 26, 1908, the weather dropped to 22 degrees of temperature.

The alfalfa in the nursery plats, a foot in height, was frozen stiff, but when the sun thawed them out, some plants were exceptionally free from injury; the *light colored foliage*, seemingly to have suffered most.

The past season, the temperature dropped to 18 degrees, on the last of April, and the alfalfa was again severely frozen back, and with the same results, of a contrast in resistance, but not uniformly in the same plants as the year before, but the *dark green colored plants*, were the most frost resistant. As a variety, the *Turkestan plats*, were the least injured; two plants from a plat of *Turkestan*

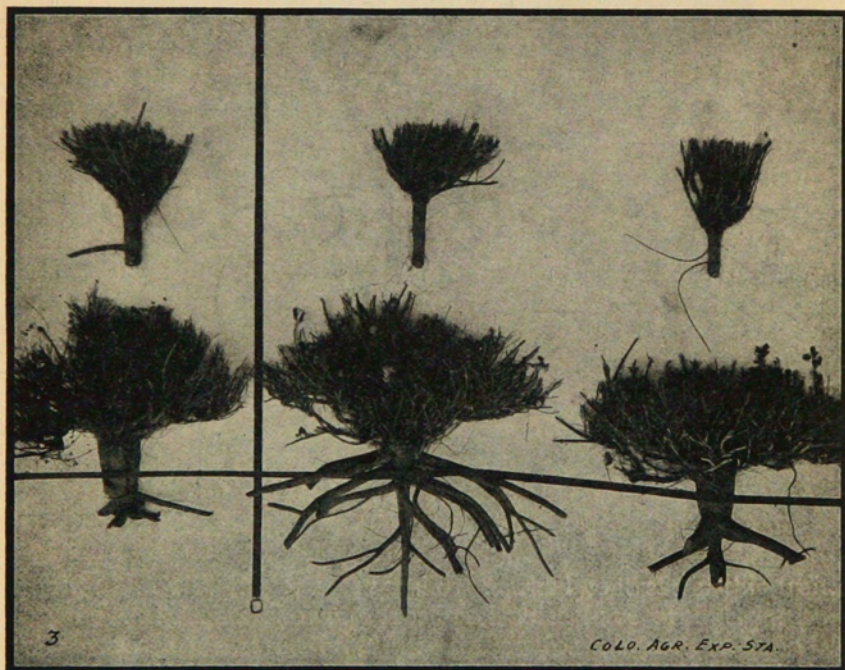


PLATE III. CONTRAST OF STOOLING HABITS

alfalfa, U. S. P. I. No. 18,425, show marked contrast in this trait.

Several plants showing frost resistance have produced seed, which has been secured for future testing for this feature.

One of the most valuable qualities in the alfalfa plant, is its *habit of stooling*, and its power to push out growth for three to four crops of hay a year, almost indefinitely; the nursery plats having been thinned to single plants twenty inches apart each way, gave

an excellent chance to observe the stooling habits of the different varieties; here again the Turkestan plats were exceptionally good, better than any other; and in some plants there is a *tendency to root down, from the crown branches*, which would be a very desirable trait, to thicken a poor stand, or to maintain a stand of alfalfa on poor soil condition, if it could be better developed.

A contrast in stooling habits is shown in Plate No. III, the larger being from the Turkestan plats, compared to common alfalfa, with main roots over an inch in diameter. In each case, the plants are three years old.

The tendency to start growth early in the spring, is a variation that is characteristic of the Turkestan alfalfa, and some others; as early as March 17, in 1908, these strains were showing green shoots three to five inches high, above the ground, while under the same conditions, the native and some other strains, remained dormant full three weeks later. It has now been observed, that a corresponding check in the growth of these very early varieties, takes place late in the fall, and it is doubtful if this variation is of any value, for the crops in the spring, are so often set back, or cut short, by the late spring freezes.

Our observations, and the reports from several other sources, have been to the effect, that horses will prefer the Turkestan alfalfa in a pasture, over the ordinary kinds. This fact seems to be well established, but a comparison of the different varieties, has not been made, nor has the reason for this preference been demonstrated, but it is doubtless due to a better flavor that the horse appreciates.

The contrasts in disease resistant tendencies, in alfalfa are sometimes very marked, but the plats that have been most affected by a disease one season, have not always been the same ones the next; so there seems to be a little question, as to the reliability of these observations. As in the case, of frost resistance, it is the dark green colored leaves that seem to be the least affected by the mildew or "leaf-spot."

The presence of leaf fungus affects seriously the leafiness of hay, and the search for plants that were the least affected, have been carefully sought in our seed selections.

The richest part of alfalfa hay is in the leaves and small stems. hence, a dense foliage, giving a *high per cent* of "*leaf-to-stem*" *quality* should be a dominant point in the selection for hay type; and selections for this point have been carefully made.

Plate No. IV, shows the contrast in the uniform production of leafy traits, in two rows, sown last May with the seed of apparently equally good selections, for this trait.



All the desirable points previously mentioned, have not been found associated with the most ideal types for hay, but a wider selection may secure the desired end.

The selections for *seed yielding traits*, have been very positive in their results, and the contrast in the production of seed in the different varieties, have been the most marked of all. Most of the Turkestan plats producing practically no seed, while others among the sixty-four plats in the nursery, have produced the phenomenal

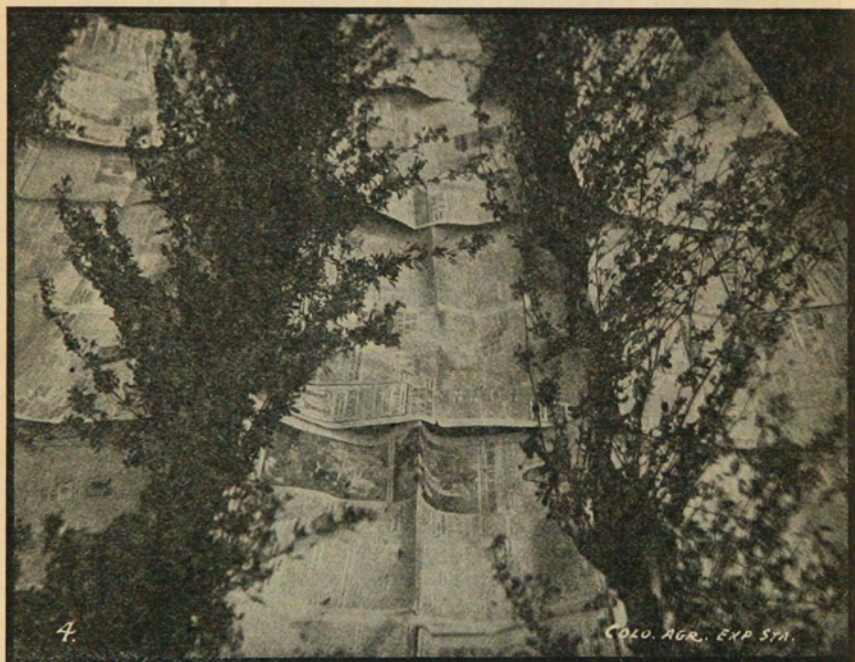


PLATE IV. CONTRAST IN LEAFINESS

yield, of two and one half pounds of clean seed, from a square rod, with less than one hundred plants.

The varieties that have been the heaviest seed yielding ones, one year, have also, been the best the following season; single plants have produced two ounces of clean seed, and the plats sown with the seed of these selections, have in turn been heavy seed producers; so that this trait is to some extent an inherent quality. We have made over a hundred selections of individual plants showing desirable qualities, and Plate No. V, shows the comparison in seed yield of a few of the average plants.

While the seed yielding tendency, may be greatly affected by the hereditary traits, it is doubtless more generally influenced by



the *climatic* and *cultural conditions*. All the observations on this point seem to indicate the fact, that outside of insect injuries, the *proper supply of moisture*, is the greatest factor in determining the seed yield of alfalfa. The heaviest yield of seed is produced, when the plants make a relatively *slow dwarfed growth*.

Under irrigation, the usual system of flooding supplies too much water, and the alfalfa grows too rank for a seed yield; on the other hand, without irrigation, the seed fails so often, to fill, on account of the lack of water. But where the roots can penetrate to *just the proper condition of moisture*, or when irrigation is applied, at just the right time and amount, the happy medium is reached, and a good yield of seed is realized.

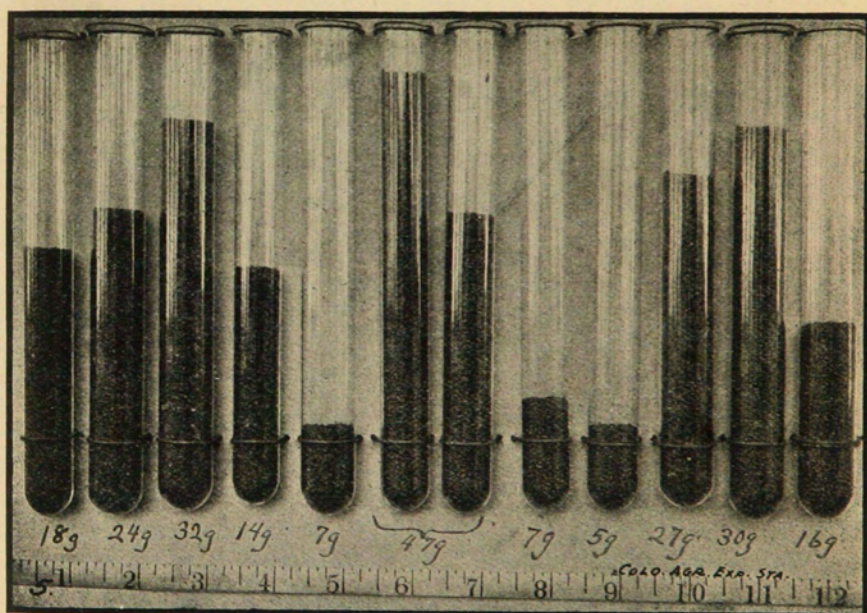


PLATE V. CONTRASTS IN SEED YIELD OF INDIVIDUAL PLANTS

Samples taken at random. Beginning at left, No. 1, Argentine; No. 2, Arizona; No. 3, dry land, Nebraska; No. 4, from Rocky Ford; No. 5, Turkestan; No. 6 and 7, U. S.; No. 8, U. S., No. 17,698, northern Montana, evidently Turkestan, 7 grams; No. 9, dry land, Nebraska; No. 10, Highmore, S. D.; No. 11, Argentine; No. 12, Argentine.

The only practical method to regulate moisture, or to control irrigation for alfalfa seed culture, is to sow the seed *in rows with space*, to permit intertillage to conserve the moisture from rains or winter irrigations, and to enable the rows being "logged" out with clear cut furrows, in about every other row; so that the lightest



possible irrigation may be applied quickly and evenly at the proper time, as the needs of the crop may demand.

A *thin stand of plants* on the ground, seems also necessary to produce good results in seed yield. The stems growing more stocky, and the plants standing some little space apart, the branches will entwine each other, so as to *brace*, and *prevent lodging from wind or heavy storms*, which is disastrous to an alfalfa seed crop.



PLATE VI. A FIVE ACRE FIELD OF ALFALFA IN ROWS TO TEST SEED PRODUCTION

The smooth furrows will also serve to provide good drainage from excessive rains.

This system has been followed in the nursery plat work, and it has been successful apparently. The plan has been reported a success in other states, and it seems practical, to be applied on a large scale for growing seed commercially.