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# Drought-Resisting Forage Plants at the Co- Operative Range Experiment Station, Highmore, S. D.

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*South Dakota Agricultural College*

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Bulletin 66.

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U. S.  
EXPERIMENT STATION  
SOUTH DAKOTA.



IN CONNECTION WITH THE  
SOUTH DAKOTA AGRICULTURAL COLLEGE.

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Drought-Resisting Forage Plants at the  
Co-Operative Range Experiment Sta-  
tion, Highmore, S. D.

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DEPARTMENT OF BOTANY.

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BROOKINGS, SOUTH DAKOTA.



SIoux FALLS, S. D.  
WILL A. UNACH, PRINTER AND BINDER.  
1900.

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DROUGHT-RESISTING FORAGE PLANTS AT  
THE CO-OPERATIVE RANGE EXPERIMENT  
STATION, HIGHMORE, S. D.

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DEPARTMENT OF BOTANY.

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JAMES H. SHEPARD, Director.

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INTRODUCTION.

Soon after the appearance of the first Bulletin from this Station announcing the results of the co-operative irrigation experiments in the James River Valley, it became evident that there was urgent need for experiments in drought-resisting forage plants in the range regions of this state.

Many requests were received from the stock men who were ranging their herds there, that such work should be done.

The matter was thoroughly discussed at the home Station and the necessity was fully admitted. But, owing to a lack of funds, no progress was made. It was even urged by the stock men that a portion of the Hatch fund should be set aside for the purpose of establishing a SubStation on the divide between the James and Missouri rivers. Even had the home Station the money to spare, a ruling of the Secretary of Agriculture made it impossible thus to employ it.

The next attempt to establish the range Station was made through the State legislature. A bill was drawn by the executive officers of the home Station and presented to the legislature in 1897 by Hon. M. F. Greeley of Gary. This bill passed, but it was unfortunately amended so that the State did not appropriate the necessary funds. But the law ordered

the Regents to set aside a portion of the Hatch fund for that purpose. Again, a ruling of the Secretary of Agriculture to the effect, that when the legislature had accepted the Hatch fund and designated the institution to which it should go, it had exhausted its functions, rendered the law a dead letter and the proposed Station was no nearer establishment than before. Here the matter rested until the winter of 1898-99.

At this time the new policy of Secretary Wilson in regard to co-operative work between the Departments of Agriculture and the various State Experiment Stations was becoming effective. During this winter Professor Chilcott of this Station was granted leave of absence which he spent in Washington among the various Scientific Divisions and more especially in the Division of Soil Physics. He was unofficially asked to learn the attitude of the Department of Agriculture towards the establishment of a Range Station in this State. He met with such encouragement from Secretary Wilson, Director A. C. True of the office of Experiment Stations, and Professor F. Lamson-Scribner of the Division of Agrostology, that the Regents of Education directed the writer to make a formal proposition to the Department of Agriculture toward establishing a co-operative Range Station. This formal proposition was most favorably received and Professor Lamson-Scribner assigned the work to Professor Thomas A. Williams, formerly of this Station, with instructions to proceed to South Dakota at once, in order to complete the details of the proposed co-operation.

The Hon. M. F. Greeley who was now a member of the Regents of Education was most deeply interested in this work. When it became apparent that co-operation was possible Mr. Greeley and the writer proceeded to Highmore in order to secure a suitable location. They met with a most cordial reception from the citizens of Highmore and a meeting of the County Commissioners was called. Hon. Frank Drew donated one hundred and seventeen acres of land for the site and the Commissioners appropriated sufficient funds to fence the tract and to place a suitable building upon it and ap-

pointed a committee to supervise the fitting up of the grounds. Hon. F. M. Barnes was made chairman of the committee and he has done most efficient work.

Soon after the arrangements were completed, Professor Williams came on from Washington and the final details were agreed upon. According to this agreement the Division of Agrostology and this Station are to carry on the work conjointly, each having equal access to all results as recorded. Each is also to furnish a portion of the necessary funds. This Station is to apply local funds in meeting its share of the obligations.

The work is to be limited to testing drought-resisting forage plants and to devising ways and means by which stockmen may obtain a supply of winter forage and increase the productiveness of the natural range.

This work will have a significance extending beyond the limit of our own state. The conditions prevailing at Highmore are typical of the vast regions of this and adjoining states; and in selecting Highmore as the point where these investigations are to be carried on, a wise choice has been made.

Professor Chilcott has prepared the following brief description of the soil and geological conditions at Highmore and has appended two tables selected from unpublished investigations now in progress in the departments of Soil Physics and Chemistry of this Station.

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### THE SOIL.

The Experimental Grounds are located at very nearly the highest point on the C. & N. W. Ry. between Huron and Pierre on the divide between the Missouri and James rivers. The altitude of Highmore is 1890 feet; these grounds are a few feet higher. The Second terminal moraine is here rather narrow and does not rise much above the surface of the surrounding country, but is well defined by considerable deposits of drift boulders of granite. The grounds are on the eastern

portion of this moraine and slope gently to the east. The log of the Highmore Artesian well shows a depth of 240 feet of "soil, clay and gravel"—presumably drift—where a five hundred foot stratum of blue clay was encountered, then about eight hundred feet of shale and sandstone. At 1537 feet the "cap rock" was struck which is here about two feet thick. Next comes the soft sandstone which was penetrated fifteen feet and a good flow of water secured. There are no surface wells near these grounds although many tests for water have been made without finding it. The soil of this tract is typical of a large area lying on the divide between the Missouri and James rivers and extending far up into North Dakota. It probably contains rather more stone, gravel and sand and less organic matter than the average prairie soil of this part of the state, and there are unquestionably many quite extensive tracts within this area that would show a marked superiority to these in this respect.

With a sufficient rainfall this would be a rich agricultural country, but with the light rainfall which has been the rule there for the past fifteen years, it is adapted only to stock raising.

Below is given a mechanical analysis of the soil, which was made in our Soil Physics Laboratory, and a chemical analysis made in the Chemical Laboratory of this Station.

#### MECHANICAL ANALYSIS (HIGHMORE).

DESIGNATION OF PARTICLES	DIA. IN M M	H. V. IN M M	SURFACE SOIL Per cent.	INTERMEDIATE SOIL Per Cent.	SUB SOIL Per C't.
Coarse Grits.....	1-3	2	.....	2.79	1.00
Fine Grits.....	.5-1	2	3.62	1.70	1.70
Coarse sand.....	.30	.04	1.18	5.65	1.75
Medium Sand.....	.30	.32	2.07	2.40	2.17
Fine Sand.....	.16	.16	3.26	8.65	5.72
Pineest Sand.....	.12	.8	2.15	3.98	5.13
Coarse Silt.....	.072	4	4.34	4.37	7.17
Large Silt.....	.047	2	6.64	11.74	5.85
Medium Silt.....	.030	1	9.75	9.47	5.75
Silt.....	.025	.5	6.27	2.37	9.38
Fine Silt.....	.010	.25	23.88	16.79	16.47
Pineest Silt.....	.010	1.25	15.16	17.23	19.45
Clay.....	.0001	1.0023	7.98	6.99	13.43
Volatile Matter.....			9.13	4.44	4.40
Total.....			95.43	98.57	99.37

## CHEMICAL ANALYSIS (HIGHMORE).

FROM HIGHMORE N. E. OF R. R. UNCULTIVATED GROUND.	SURFACE SOIL.	INTERMEDIATE SOIL	SUB SOIL
Insoluble Residue .....	80.9640	82.5310	89.2825
Potash (K <sub>2</sub> O).....	.1090	.4796	.1074
Soda (Na <sub>2</sub> O).....	.6068	1.6062	.5518
Lime (Ca O).....	.4344	.4683	.4344
Magnesia (Mg O).....	.6036	.8270	1.2610
Manganous oxid (Mn O).....	0.0000	0.0000	0.0000
Alumina (Al <sub>2</sub> O <sub>3</sub> ).....	5.7577	6.2991	6.5576
Ferric oxid (Fe <sub>2</sub> O <sub>3</sub> ).....	1.5693	2.6557	3.6214
Phosphorus pentoxid (P <sub>2</sub> O <sub>5</sub> ).....	.1955	.2302	.0735
Sulfur Trioxid (S O <sub>3</sub> ).....	.1390	.1321	.0916
Organic Matter .....	8.4618	4.7564	4.2920
Carbon dioxid (C O <sub>2</sub> ) and loss....	1.2549	.0142	.7228
Total.....	100.0000	100.0000	100.0000
Grits - quartz and granite .....	4.39	2.24	2.01
Depth samples taken .....	5 in	5 to 20 in	20 to 30 in

The chemical analysis shows the soil to be rich in mineral plant foods but somewhat deficient in organic matter. An increase of organic matter would not only add to its fertility but would also help to conserve the moisture. This deficiency in organic matter may be traced to the following causes. It is on a divide where organic deposits would not naturally accumulate. It has been burned over annually for a length of time impossible to estimate. Since the advent of settlement it has been closely grazed. Knowing the causes that have led to this depletion it ought not to be difficult to devise means looking to the amelioration of the region.



# CO-OPERATIVE RANGE EXPERIMENT STATION, HIGHMORE, SOUTH DAKOTA.

D. A. SAUNDERS, Botanist.

## RESULTS OF THE FIRST YEAR'S EXPERIMENTS.

Plat A (1). Thirty-four rows on the east side were sown to smooth bunch grass (*Poa laevigata*). The seed was collected by Shear and Bessey in Colorado in 1898. Rather a thin stand was obtained from the seed that was drilled. The seed was sown May 10th, was up May 23d; October 23d the grass was two to three inches high, healthy and green.

The smooth bunch grass is a native of the Eastern Rocky Mountains, especially in Southern Wyoming and Central and Western Colorado. Under cultivation it loses, somewhat, its tendency to form bunches. It is very resistant to dry weather and if it lends itself readily to cultivation it will become a desirable range grass. The remainder of this plat was sown to bunch red top (*Poa buckleyana*), another promising bunch grass. The seed sprouted well and a fairly good stand was obtained but the plants all died out in June. The bunch red top is one of the most common and most valuable bunch grasses. It forms a considerable amount of the forage of the high plains of Wyoming and Colorado. It should be given another trial.

Plat A (2). This plat was sown broadcast to an undetermined species of bunch grass (*Poa* Sp.) which was collected by Griffiths in Wyoming in 1898. The plants were up in two weeks but a very thin stand was obtained, due principally to the very weedy condition of the seed bed.

Plat A (3). This plat was sown to Nevada blue grass (*Poa nevadensis*). The seed of this was collected by Williams

and Griffiths in Wyoming in 1898. One-half of the plat was sown in drills and the other half broadcast. A fair stand was obtained on that portion of the plat sown broadcast. The last of October the grass was three inches high, green and thrifty.

The Nevada blue grass is native from the Black Hills westward to eastern and central Washington. It has an abundance of ample leaves and is apparently given a preference by range animals.

Plat A (4) was sown broadcast May 10th to Oregon Brome (*Bromus unioloides*) from seed obtained from Oregon. The seed came up in twelve days; on August 5th the grass was from twelve to eighteen inches high and very thrifty. A bushel and a half of seed was gathered August 5th.

The Oregon Brome is native of the prairies and dry, sandy fields of Texas, Indian Territory, Arizona and Northward. It is normally an annual, but has shown a tendency to become a perennial. If this condition can be brought about it will certainly be a very desirable grass.

Plat A (5). The eastern four-fifths of this plat was sown to short awned brome grass (*Bromus breviaristatus*) from seed collected by Williams and Griffiths in Wyoming in 1898. A good, even stand was obtained and on October 23d the grass was two to three inches high and still green.

The short awned brome grass is a native of dry soils from Western Nebraska to Arizona, California and northward into Manitoba and British Columbia. It promises to be a valuable grass for grazing purposes.

The last row on the west of this plat was sown to Langsdorff's reed-bent grass (*Calamagrostis langsdorffi*). The seed failed to germinate.

Six rows on the west side of Plat A (5) were drilled in to Safflower (*Carthamnus tinctorius*). The Safflower proved to be perfectly hardy, making a growth of from two to three feet and ripened its seed early in September. It is raised in Russia and Germany for the oil that is extracted from the seed and for the red dye which it affords.

Plat A (6) was drilled to King's fescue (*Festuca kingii*) from seed collected by Williams and Griffiths in Wyoming. The seed was sown May 12th; sprouted and up May 24th; made a good stand. ●n October 23d it was from three to four inches high and still a bright green.

King's fescue is a native of dry mountain sides from Colorado to Nevada, Montana and ●regon. It gives promise of becoming a valuable range grass.

Plat A (7). A part of this plat was reserved for the seed and tool house. The remainder was sown to three kinds of imported millets, all failing to grow except a black millet—South Dakota Experiment Station No. H-19—which made a growth of from twenty-four to thirty-six inches high and ripened a great quantity of exceptionally large black seed. This seed was collected by Professor Hansen from plants growing wild in their native habitat in Russia.

Plat A (8). The first four rows on the east side of this plat were sown to woodland rye-grass (*Elymus glaucus*) from seed collected by Williams and Griffiths in 1898, and a good stand was obtained. ●n August 5th it was from eight to ten inches high. It stood the dry summer well and on October 23d was still bright and green. The fifth and sixth rows of this plat were drilled to bearded wheat (*Agropyron caninum*) from seed collected by Shear and Bessey in Colorado. The seed failed to germinate. The seventh, eighth and ninth rows of this plat were sown to bearded wheat grass (*Agropyron caninum*) from seed grown in the United States Grass Gardens. This seed also failed to germinate. The next nine and one-half yards were sown to feather bunch grass (*Stipa viridula*) from seed collected by Griffith in South Dakota in 1898. A very thin stand was obtained. The west half of this plat was sown broadcast to bearded wheat grass (*Agropyron caninum*) from seed collected by Williams and Griffiths in Wyoming in 1898. A fair stand was obtained which on ●ctober 23d was curing on the ground but still green at the bottom.

Plat A (9) was drilled May 11th to Giant rye-grass (*Elymus*

condensatus) from seed collected by Williams and Griffiths in Wyoming in 1898. A good stand was obtained which was ten inches high on July 26th, from then until August 5th a growth of one to two inches was made and the plat had begun to rust badly. On October 24th the grass was dead, having been killed by frost.

Plat A (10) was sown broadcast to six lots of slender wheat grass (*Agropyron tenerum*). Five of the lots were collected by Williams and Griffiths in Wyoming and Montana, and one lot by Shear and Bessey in Colorado. They all made a good stand and on August 5th were twelve inches high.

Plat A (11) was also drilled to slender wheat grass (*Agropyron tenerum*) from seed collected by Shear and Bessey in Colorado in 1898. There was a great difference in the time of heading of this plant. Rows six to twenty-six were a darker green, smaller and later in heading. On October the whole plat was rusting, but still green.

The slender wheat grass is native of dry soils from Minnesota and Nebraska to Colorado and northward into the Northwest Territory. Next to the smooth brome it is the most promising grass for both pasture and hay.

Plat A (12) was sown broadcast to wild timothy (*Muhlenbergia racemosa*). It was sown May 11th; sprouted and up June 6th, and on August 5th there was a very thin weedy stand, three to four inches high. It was mown on July 31st, to kill the weeds. On October 25th the plants were all dead, having been killed by frost.

Plat A (13). The first eight yards on the east side of this plat were sown to curly mesquite (*Hilaria cenchroides*) seed sown broadcast May 11th; sprouted and up June 1st. A very thin stand was obtained which was mown July 31st to kill the weeds.

The curly mesquite is a native of dry soils from Arizona and New Mexico to Southern California. If it stands the northern winters it will be a valuable addition to our range grasses.

The next eight yards of this plat was sown broadcast to

Blue grama (*Bouteloua oligostachya*). The seed was collected by Williams and Griffiths at Billings, Montana, in 1898. The seed was sown May 11th, sprouted and up May 27th. A thin stand was obtained and the plat was very weedy.

The next five yards in this plat were sown broadcast to Blue grama (*Bouteloua oligostachya*) from seed collected by Williams and Griffiths in Montana in 1898. The seed was sown May 11th; sprouted and up June 4th. A thin stand was obtained which was mowed July 31st to kill the weeds.

The remaining four yards of this plat were sown to King's fescue (*Festuca kingii*) from seed collected by Williams and Griffiths in Wyoming in 1898. The seed was sown broadcast May 13th; sprouted and up May 26th. The plat was mown July 31st to kill the weeds.

Plat A (14). This plat was sown to Blue grama (*Bouteloua oligostachya*). The seed on the west half of the plat was obtained from Walla Walla, Washington. A thin stand was obtained which was mown July 31st to kill the weeds.

Blue grama, more commonly called false buffalo grass, is a native of prairies from Missouri to Texas, Oregon and northward to British Columbia. In the central and western part of the Dakotas it forms three-fourths of the forage on the ranges. An attempt is being made to improve it by cultivation and selection.

Plat A (15), Mixed grama. The seed of several species of grama grass were sown broadcast on this plat May 11th; it was sprouted and up June 8th. A very thin stand was obtained which was mown July 31st to kill the weeds.

Plat A (16). The first twenty-two rows on the east side of this plat were drilled to false couch grass (*Agropyron pseudorepens*) from seed obtained from Texas. The seed failed to germinate.

The next eleven rows of this plat were sown to annual saltbush (*Atriplex holocarpa*). The seed was grown in the United States Grass Garden in 1898. The seed failed to germinate.

The next twenty-four rows of this plat were sown to silvery

saltbush (*Atriplex argentea*). The seed was collected by Williams and Griffiths in Montana in 1898. The seed failed to germinate.

The saltbushes grow on alkaline plains, along the margins of brackish ponds and on sterile lands. They are perfectly adapted to conditions where better forage plants will not grow. Nearly all are annuals with small, fleshy leaves and harsh, rigid stems, and are protected by various natural devices from the dry influence of the fierce summer heats. These plants indigenous to semi arid conditions produce immense quantities of seed to insure reproduction of the species under the very unfavorable conditions which prevail.

There are some thirty species of saltbushes native to the western plains, nearly all of which are recognized by the herders and grazers as furnishing a considerable proportion of the forage for sheep and cattle. In dry seasons and during severe winters they are supplementary to the native grasses and their abundance adds to the value of the range.

The last six yards on the west side of this plat were sown to wire bunch grass (*Agropyron divergens*). This seed was collected by Williams and Griffiths in Wyoming in 1898. It was sown May 13th. A thin stand was obtained; mown July 31st to kill weeds, three to four inches high October 24th and still green.

Plat A (17 and 18). These two plats were sown to hairy or sand vetch (*Vicia villosa*). The seed was imported from Russia by the United States Department of Agriculture. It was drilled in May 12th; sprouted and up May 26th. On July 26th the plants were two to four feet long. Nearly all were killed by hot winds July 15th to 20th. Around the edges and next to the paths it made a good growth and blossomed in August and September, but failed to mature the seeds. On October 24th it was still green and would have made good pasture.

The hairy vetch is an annual and a native of Western Asia and has been cultivated for about fifty years. It is an excellent soiling crop but the high price of the seed and the large

amount which must be sown per acre has prevented it from being widely cultivated.

Plat A (19 and 20). These plats were sown broadcast May 23d to Turkestan alfalfa (*Medicago sativa* var. *turkestanica*). The seed was from the Section of Seed and Plant Introduction, No. 991. Sprouted and up May 29th. The plant grew nicely until the first of July, when it was six to eight inches tall. The dry weather in July and August stopped the growth and damaged it badly.

Although more resistant to drought and cold than the common alfalfa the Turkestan variety may require irrigation at least in the western part of the state in order to produce a satisfactory growth during the dry season.

Plat A (22 and 23). These two plats were sown to western wheat grass (*Agropyron spicatum*) from seed collected by Williams and Griffiths in Wyoming in 1898. The seed was sown broadcast May 11th; it was sprouted and up June 4th. A good stand was obtained which was mown July 31st to kill the weeds. On October 24th it was three to four inches high and still green. The western wheat grass is native from Wisconsin to Texas and Washington, and is one of the most nutritious of our native grasses.

Plat A (21, 24 to 29 inclusive). These plats were sown broadcast May 10th to smooth brome grass (*Bromus inermis*). The seed was grown at the South Dakota Experiment Station at Brookings, South Dakota; it was sprouted and up by May 21st. On July 26th there was a good stand from four to six inches tall, it was mown on July 31st to kill the weeds. On October 24th it was still green, five to six inches high and very thrifty. This grass made the best showing of any of the grasses.

Smooth brome grass is a native of Europe and Asia, ranging from France eastward into Siberia. It grows along road sides, borders of fields and woods, and upon sterile hill sides and pastures. It is a vigorous, hardy perennial with a strong creeping root stock, a smooth upright, leafy stem one to four feet high, and a loose, open paniced seed head four to eight

inches long. In a few years it forms a very tough sod, soon crowding out all other grasses, clovers and weeds. Its remarkable drought resisting qualities have proved it to be the most valuable grass for dry regions where other grasses could hardly exist.

As it is thoroughly permanent and grows with wonderful rapidity, producing heavy crops and luxuriant pasture its value to the farmers in dry regions cannot be overestimated. All kinds of stock eat it with relish and the chemical analysis shows that it is rich in flesh forming ingredients—much more so than timothy. It is very hardy and not injured by spring and fall frosts when once established.

Smooth brome grass has been grown at the South Dakota Experiment Station for nearly ten years. It is perfectly hardy, resisting both drought and cold weather. It starts in the spring more than two weeks earlier than our native grasses, and in the fall when the native prairie is seared brown, the brome grass is bright and green, thus furnishing an abundance of forage when it is most needed.

Reports so far received from the numerous sacks of seed sent out from this station a year ago are without exception very favorable.

Plat B (1). Original prairie. Broken in June. Not planted.

Plat B (2). North half of this plat was drilled to Hagi (*Lespedeza bicolor*), introduced from Japan by the Section of Seed and Plant Introduction. A very thin stand was obtained. It grew to be twenty-four to thirty inches high but did not come into bloom. Had a single stalk and was very woody.

Plat B (3). Earliest ripe fodder corn. Seed from J. A. Salzer Seed Co. It was planted in rows twenty-two inches apart May 24th, sprouted and up June 1st. Part of this plat was drilled and part planted in hills fourteen, twenty-eight and forty-two inches apart in the rows. The drilled portion suffered from drought in July and only grew to be from two to three feet high. The thinnest planting made the coarsest



fodder and the yield seemed to be heavier. The wind blew the corn together so that the different sections of plat could not be weighed separately; tasseled July 27th, cut September 11th, weighed October 20th,

It yielded on one-quarter acre 400 pounds, or at the rate of 1,600 pounds per acre. This plat is on some of the lowest ground under cultivation. The tallest corn was from three and one-half to four feet high.

Four rows on the west side of this plat were sown to yellow milo maize; seed furnished by Mr. J. C. Stoner, of Highmore. It was old and failed to germinate.

Plat B (4). Salzer's Superior fodder corn; seed furnished by J. A. Salzer Seed Co. It was planted May 24th in rows 22 inches apart, hills 14, 28, and 42 inches apart in the row. As in the preceding plat the corn planted farthest apart made the largest growth. It was sprouted and up June 1st; July 27th, three to four feet high; very rank growth. Most of it tasseled out before September 1st. Cut September 11th, four to seven feet high, weighed October 20th, weight for one-quarter acre 810 pounds, or at the rate of 3,240 pounds per acre.

Plat B (5, 6, 7 and 8). Sown broadcast to Turkestan alfalfa (*Medicago sativa* var. *turkestanica*) at the rate of 25 pounds per acre; seed from Section of Seed and Plant Introduction, No. 991; sown May 21st; sprouted and up May 27th, made a fine growth up to July 4th; badly damaged by hot winds July 15th to 20th; six to ten inches high July 1st. It did not grow any taller. It was still alive and fresh October 24th.

Plat B (9). Earliest ripe fodder corn; seed from J. A. Salzer Seed Co. This was planted May 24th in hills forty-two inches apart; sprouted and up June 2d; July 27th, three to four feet high; thin stand; cut September 11th. It had quite a number of small ears. It was weighed October 20th, weight, dry fodder, 310 pounds, or at the rate of 1,240 pounds per acre. This fodder was badly blown about by the winds.

Plat B (10). Jerusalem corn; seed from J. A. Salzer Seed Co. Half of this plat was drilled and half sown broadcast. The stand was thin. The seed did not germinate well. Three rows on the east side of plat were left to ripen seed, and they yielded one peck. The seed ripened in September. The corn on part of the land sown broadcast grew to be two or three feet high; that drilled, three to four feet. It was cut September 11th. The weight was estimated at 300 pounds or at the rate of 1,200 pounds per acre.

Plat B (11). Salzer's Superior fodder corn; seed from J. A. Salzer Seed Co. This was planted in hills forty-two inches apart May 24th; sprouted and up May 31st; made a good growth; July 27th was four feet high; cut September 12th; five to six feet high at time of cutting; weight October 20th, 500 pounds, or at the rate of 2,000 pounds per acre. The land being higher than Plat B (4), this corn did not make so thrifty a growth as on that plat.

Plat B (12). The east half of this plat was planted to Wisconsin amber cane; seed from J. A. Salzer Seed Co.; drilled May 25th; sprouted and up June 14th; about 75 per cent. of a stand; July 27th, two and one-half to three feet tall; badly damaged by hot winds; cut September 13th. Three rows were left to ripen seed. About one-half of this was badly affected by smut.

Plat B (12). West half of plat planted to hairy vetch (*Vicia villosa*) and Jerusalem corn; sown broadcast May 25th; the vetch was sprouted and up June 2d; corn sprouted and up June 8th; badly damaged by drought in July; very weedy. September 1st both corn and vetch were dead except a little near the edges of the plat.

Plat B (13). The east half of plat was sown to Dwarf Victoria rape; drilled in rows one foot apart May 25th; sprouted and up May 30th. This seed was sown too thick. July 27th it was one to one-half feet high. It did not grow any after July. The yield was four to five tons of green fodder per acre.

The west half of plat was sown to Dwarf Victoria rape and

Wisconsin amber cane. Sown broadcast May 25th; rape sprouted and up June 2d; cane sprouted and up June 13th; plat was sown too thick; cane all died; rape six inches high; the rape did not grow any after July.

Plat B (14). Salzer's Superior sand vetch (*Vicia villosa*). The east half of plat sown in drills two feet apart while the west half of plat was sown broadcast. Sown May 25th; sprouted and up May 31st; July 27th, drilled portion, one to one and one-half feet long; did not grow any more. That sown broadcast died from hot winds in July.

Plat B (15). Salzer's Superior fodder corn; seed from J. A. Salzer Seed Co. This was planted in hills 42 inches apart May 25th; sprouted and up June 4th. July 27th, 75 per cent. of a stand, four feet high; cut September 13th; five to six feet high; weight, October 10th, 500 pounds, or at the rate of 2,000 pounds per acre.

Plat B (16). Earliest ripe fodder corn; seed from J. A. Salzer Seed Co. This was drilled May 25th, in rows 42 inches apart; sprouted and up June 3d; tasseled out July 27th; three to three and one-half feet high; cut September 11th; a few ears of corn on stalks; weight, October 20th, 300 pounds, or at the rate of 1,200 pounds per acre.

Plat B (17). Hairy vetch (*Vicia villosa*). The east half of plat was drilled; the west half was sown broadcast. It was sown May 26th; sprouted and up May 30th; July 27th, in blossom; one to two feet long on drilled portion. The part of the plat sown broadcast was dried out and destroyed by dry weather. A few plants next to paths made a good growth and blossomed, but did not mature seeds.

Plat B (18). Kaffir corn; seed from J. A. Salzer Seed Co.; half of plat drilled and half sown broadcast. It was sown May 26th; sprouted and up June 12th; germination poor; portion sown broadcast killed by weeds and dry weather; drilled corn two to two and one-half feet high; part of it left for seed, part cut September 13th. None of that left for seed filled. It was weighed October 20th, yielding at the rate of 1,500 pounds per acre.

Plat B (19). Combination plat—sand vetch, alfalfa, and Kaffir corn. This was sown broadcast and drilled May 26th; sprouted and up June 1st; portion sown broadcast dried out and died; July 27th, drilled portion of corn, two feet high; vetch, one to two feet long; alfalfa, eight to ten inches. These did not grow any after July. October 20th the alfalfa and sand vetch were still green but not growing.

The rest of Series B was planted to fodder corn and cultivated to keep the ground clean.

Plat C (1 and 2). New breaking, not planted.

Plat C (3 to 6). Common millet (*Chaetochloa italica*); sown for feed at the rate of twelve quarts per acre. This was sown June 7th; sprouted and up June 16th; cut for hay August 8th. This millet was on high ground and suffered badly from drought in July. It yielded 1,740 pounds of hay.

Plat C (12). Red Orenburg broom-corn millet (*Panicum miliaceum*); seed from Section of Seed and Plant Introduction, No. 2,960. Sixteen rows on the east side of plat were drilled June 16th; sprouted and up June 23d; very poor germination; July 27th, one and one-half feet high; low and spreading; seed red; heads compact and heavily seeded. About two quarts of seed of this variety were saved.

Plat C (12). Black Russian broom-corn millet (*Panicum millaceum*); seed from Section of Seed and Plant Introduction, No. 2,795. Eighteen rows were drilled June 16th; July 27th, one and one-half feet high; very rank growers; September 1st, two to two and one-half feet high; seed ripe. This is a black seeded millet and the best of the Russian millets tried. One and one-half quarts of seed were raised.

Plat C (12). Red Veronezh broom-corn millet (*Panicum miliaceum*); seed from the Section of Seed and Plant Introduction, No. 2,796. Twenty-five rows were drilled June 16th; poor germination; July 27th, one and one-half feet high; plants low and spreading; heads long; seed red. Three quarts of seed were raised.

Plat C (13). Tambo y broom-corn millet (*Panicum miliaecum*); seed from Section of Seed and Plant Introduction,

No. 2,794. Fifteen rows were drilled June 16th; sprouted and up June 23d; very poor germination of seeds; July 27th, headed out, one foot high; plants low and spreading. Two quarts of seed were raised from this number.

Plat C (13). Red Russian broom-corn millet (*Panicum miliaceum*); seed from the Section of Seed and Plant Introduction, No. 2,797. Fourteen rows were drilled June 16th; sprouted and up June 23d; poor germination; July 27th, headed out, one and one-half feet high; heads long and spreading, seeds red. Two quarts of seed of this millet were saved.

Plat C (14). Kursh millet (*Chaetochloa italica*); seed from the Section of Seed and Plant Introduction, No. 2,798. Thirty-one rows were drilled June 16th; sprouted and up June 24th; July 27th, very thick, one foot high; August 1st, headed out at sixteen to eighteen inches high; damaged by hot winds; heads one to three inches long. Eight quarts of seed were saved.