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Drought Resistant Forage Experiments at Highmore Substation

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South Dakota Agricultural College

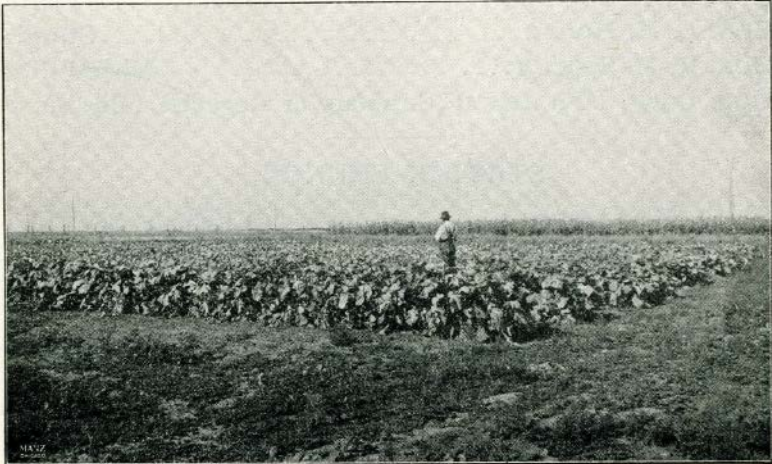
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South Dakota Agricultural College.
EXPERIMENT STATION.



DWARF VICTORIA RAPE. (SEE PLAT B II.)

Drought Resistant Forage Experiments

AT HIGHMORE SUBSTATION,
DEPARTMENT OF BOTANY.

D. A. SAUNDERS, BOTANIST.

BROOKINGS, SOUTH DAKOTA.



SIoux FALLS, S. D.
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1902.

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DROUGHT RESISTANT FORAGE EXPERIMENTS.

The Co-operative Range and Forage Experiments at Highmore were begun in 1899 in co-operation with the Division of Agrostology of the United States Department of Agriculture. Increased funds supplied both by the Department of Agriculture and the State have been of great advantage in carrying out the experiments already begun.

The following brief summary will indicate a few of the results already obtained:

1. Nevada Blue Grass, Feather Bunch Grass, Western Wheat Grass and Brome Grass have given promise of being useful for range renewal. No perennial has yet been found which will give a satisfactory yield of hay.

2. Several Annuals have shown themselves to be very drought resistant and to give satisfactory yields under adverse conditions. Sorghums, corns and millets, in the order named, are the most to be recommended for winter feed.

3. Rape when cultivated has done well, yielding as high as fourteen tons of green fodder per acre.

4. Both manuring and pulverizing of native "over-fed" prairie have caused a great increase in the yield of hay per acre.

The following is the report of Mr. L. W. Carter, who is in charge of this work:

The season of 1901 opened very favorably. The ground was filled with moisture from the fall rains and although the native grasses did not start until the middle of April, by the 1st of May they were much larger than usual at that time.

A small sedge (*Carex stenophylla*) blossomed in May and the prairies were covered so thickly in places that they looked brown. The sedge formed the bulk of the early feed. A large number of the native grasses headed out during the summer. *Calamagrostis montanensis* headed out thickly in places where it had hardly been noticed, showing that it comprised quite a large percentage of the pasturage. Fireweeds came up very thickly all over the prairies and in permanent plats so that no weights could be made on account

of the weeds. Plats A (13 to 18) and B (18 to 23) were plowed and sown broadcast to different grasses. The seed started, but the Pigeon Grass grew so thickly that they were kept mown to keep the weeds down, and nothing definite can be told about them until next year. The dry weather in July retarded the growth of the millets on Plats C (22 to 30) and when the rain came in August the weeds grew very thickly in the plats sown broadcast. The cultivated corns and sorghums did not show the effects of the drought or hot weather where they were kept clean and well cultivated. Three lines of work were kept in view, the making of permanent plats of perennial grasses under ordinary field conditions, experiments with annual forage crops, and experiments in improving the native range by resting, manuring and pulverizing.

Arrangements to fence a pasture and build a barn for the team used at the Station have been made. A complete sulky cultivator for shallow and deep cultivation, and a seed cleaner were bought for the Station this fall. A subsoil plow and a two-horse grain drill would be valuable additions to the Station outfit.

The rainfall for the summer of 1901 was as follows: April, .57 in.; May, .72 in.; June, 5.93 in.; July, 1.42 in.; August, 2.34 in.; September, 3.93 in. Total for six months 14.91 inches.

Of the native and introduced grasses, *Poa compressa*, *Poa nevadensis*, the Wheat grasses (*Agropyron spicatum*, *A. tenerum*, and *A. caninum*), *Stipa viridula* and Smooth Brome Grass have proven good hay grasses, but we believe the main reliance for winter forage in this section will be on the annuals, millets, sorghums and corn. Seed has been raised here of Wisconsin Amber Cane for the past three seasons. Some stalks always head out earlier than others and the earliest has been saved for seed. In this way an earlier variety will be developed.

Plat A (1).—Sown broadcast to Smooth Bunch Grass (*Poa laevigata*) in 1899. Started April 15th. May 1st, 3 to

4 inches high; May 23, began heading; June 1st, headed out 12 inches high. The dry spell between May 23rd and June 2nd kept the grass from getting very tall and the seed did not fill. Dried up in July during the hot weather but began to grow again in August and September and made good fall pasture. Green all through November and until snow came in December.

Plat A (2).—East half. Bunch Grass (a form of *P. laevigata*). Started April 15th. May 1st, 3 to 4 inches high; May 23d, began heading; June 1st, headed out 12 inches high but did not make much seed. Mown in June.

Plat A (2).—West half. Sown broadcast to Canadian Blue Grass (*Poa compressa*) in 1899. Started April 15th. May 1st, 2 to 3 inches tall; June 1st, 6 to 8 inches high; June 15th, beginning to head; June 20th, headed out 12 to 14 inches high. Has formed a good sod. Was mown in July and kept green until winter began but did not grow very tall.

Plat A (3).—Nevada Blue Grass (*Poa nevadensis*). Sown broadcast in 1899. Started April 12th. May 1st, 8 inches high; May 23rd, headed out 20 to 24 inches high; ripened June 15th. Mown in July and stayed green all the fall. Does not form as nice a sod as Plat 2.

Plat A (4).—Sown in 1900 to Oregon Brome Grass (*Bromus unioloides*). This is evidently an annual as more grew this year. Plat was finally plowed up and harrowed to be used next season.

Plat A (5).—Sown in 1899 to short Awned Brome Grass (*Bromus breviaristatus*). Very thin stand. Started April 15th. May 1st, 3 to 4 inches tall; May 15th, 5 to 6 inches high; June 1st, beginning to head out; June 14th, headed out 18 to 20 inches high. This plat is very badly mixed with Slender Wheat Grass and was very weedy this year.

Plat A (6).—Drilled in 1899 to King's Fescue (*Festuca kingii*). Started April 15th. May 1st, 2 to 3 inches high; June 1st, 6 inches high and beginning to head; June 14th, very little headed out. Has not spread so as to form a sod, but grows in bunches. Badly dried out in July.

Plat A (8).—East half. Sown in 1899 to Bearded Wheat Grass (*Agropyron caninum*). Started April 15th. May 1st, 3 to 4 inches high; June 1st, 6 inches high; June 14th, beginning to head; June 20th, headed 20 to 30 inches high. Stand thin; does not form a thick sod.

Plat A (8).—West half. Sown to Feather Bunch Grass (*Stipa viridula*) in 1899. Started April 15th. May 1st, 8 inches high; May 23d, heading out 18 to 20 inches; June 14th, 24 to 28 inches tall, almost ripe. One of our best native hay grasses. Stands dry weather well and grows tall enough to cut for hay.

Plat A (9).—Giant Rye Grass (*Elymus condensatus*). Sown in 1899. Started about April 15th. May 1st, 8 inches high; May 23d, 20 to 24 inches high; June 14th, 24 to 26 inches high. Did not head out. A large coarse grass but does not stand dry weather well; dried down to the ground in July but started again after the rains began in August.

Plat A (10).—Sown broadcast in 1899 to Slender Wheat Grass (*Agropyron tenerum*). Started April 12th. May 1st, 2 to 3 inches high; May 23d, beginning to head out; June 1st, headed out 18 to 20 inches high.

Plat A (11).—Drilled in 1899 to Slender Wheat Grass (*Ag. Tenerum*). West four-fifths of plat was most all killed by dry weather last year. Each side of plat is a poor stand and getting very thick. Started April 12th. May 1st, 2 to 3 inches high; June 1st, 6 to 8 inches high, beginning to head; June 15th, headed out and 20 inches high.

Plat A (12).—Sown broadcast in 1899 to Wild Timothy (*Muhlenbergia racemosa*). Thin stand. Started May 1st. June 1st, 6 to 8 inches high; June 15th, beginning to head out; June 25th, 10 to 12 inches high, headed out.

Plat A (13).—Sown broadcast May 1st to Giant Rye Grass (*Elymus condensatus*) No. 34 Div. Agros. Sprouted and up May 15th.

Plat A (14).—Sown broadcast May 1st to (*Bromus marginalis* No. 29 Div. Agros). Sprouted and up May 15th.

Plat A (15).—Sown broadcast May 1st to Yellow Spear

Grass (*Poa lucida*) No. 1 Div. Agros. Sprouted and up May 10th. Thin stand.

Plat A (16).—Sown broadcast May 1st to Sand Rush Grass (*Sporobolus cryptandrus*) No. 116 Div. Agros. Sprouted and up May 10th.

Plat A (17).—Sown broadcast May 1st to Timothy Grama (*Lycurus phleoides*) S. S. P. I. No. 5061. Sprouted and up May 10th.

Plat A (18).—Sown broadcast May 1st to Indian Millet (*Eriocoma cuspidata*) Div. Agros. No. 41. Sprouted and up May 10th.

Plats A (19, 20).—Sown broadcast to Turkestan Alfalfa in 1899. Did not winter kill. Started April 10th. May 1st, 6 to 8 inches high; June 1st, east side, 10 to 20 inches high; west side, higher ground, 8 to 12 inches high. Badly damaged by dry weather in May. June 14th, beginning to blossom. Seed did not fill and plants all died back to the ground in July but started again in August and September.

Plats A (22, 23, 24).—Sown broadcast in 1899 to Western Wheat Grass (*Agropyron spicatum*). Started April 12th. May 1st, 6 to 8 inches high; June 14th, beginning to head. Only a little headed out. This grass has spread very rapidly and almost covers the ground.

Plats A (21, 25 to 30 inclusive).—Sown broadcast in 1899 to Smooth Brome Grass (*Bromus inermis*). Started April 10th. May 1st, 6 to 8 inches tall; May 23d, beginning to head out. Very little headed out. Got ripe June 20th. These plants dried out badly in July but started up again in August and stayed green until winter. Has formed a very thick sod. Yielded hay at the rate of 1200 pounds per acre.

Plats B (1, 2, 3).—Planted June 3d to corn; four varieties from Cairo, Egypt, and one variety (Dreps corn) from Prof. D. A. Saunders. Planted as follows:

1. 8 rows on south side, No. 3999.
2. 8 rows next north, No. 4000.
3. 8 rows 3d lot from south, No. 4251.
4. 8 rows 4th lot from south, No. 4257.
5. 7 rows 5th lot from south, Dreps corn.

Ground was too dry to plant until after the rain of June 2d. Seed No. 3999 was poor and only made half a stand. Plats 2 and 3 subsoiled 14 inches deep last year and the corn was 12 inches higher on these two plats.

These Egyptian corns require a longer season than we have here. We had no killing frosts until after the middle of September but they did not get ripe. The Dreps corn seems to be a cross between Flint and Dent corn. Ripened in ninety days but the ears are very low, almost on the ground, and there are many suckers.

Plat B (4).—East half French Alfalfa, west half Samarkand Alfalfa. Drilled in rows 1 foot apart, in 1900, and cultivated. Wintered in good shape. Started April 12th. May 1st, 8 inches high; June 1st, 12 to 14 inches high. Blossomed June 15th to 30th. Seed did not fill on account of dry weather in July. No difference could be seen in these two varieties in resisting drought. The French Alfalfa grew the tallest and would have made most hay.

Plats B (5 to 9).—Turkestan Alfalfa sown in 1899. Started April 12th. May 1st, 8 inches high; June 1st, the east side was 20 inches high; west side, which is on higher ground, 8 to 10 inches high. Badly damaged in May and July by dry weather but started up again in August and September. One plat cut for hay yielded 250 pounds or at the rate of 1000 pounds per acre.

Plat B (10).—Drilled May 9th to Sand Vetch (*Vicia villosa*). Seed old and failed to grow.

Plat B (11).—Dwarf Victoria Rape (*Brassica napus*). (See frontispiece.) Drilled in rows 30 inches apart, May 8th. Cultivated with wheel, hoe and harrow-tooth cultivator. Sprouted and up May 15th. June 1st, 3 to 4 inches high; July 1st, 10 to 14 inches high; July 25th, badly dried out; September 15th, 24 to 28 inches high. Yield September 20th, at the rate of 14 tons green feed per acre.

Plat B (12).—East side 22 rows drilled in 30 inches apart to Bitter Vetch (*Lathyrum sativus*) No. 1175. Drilled May 7th. Sprouted and up May 15th. June 1st, 3 to 4

inches high; June 14th, 6 to 8 inches; July 1st, 10 to 14 inches; in blossom. Yielded seed at the rate of $5\frac{1}{8}$ bushels per acre. Vines did not get very long but dry weather does not seem to affect them.

Plat B (12).—West side drilled 30 inches apart to March Rape. Drilled May 9th. Sprouted and up May 15th; June 1st, 2 to 3 inches high. Does not have many leaves and sends up seed stalk first summer.

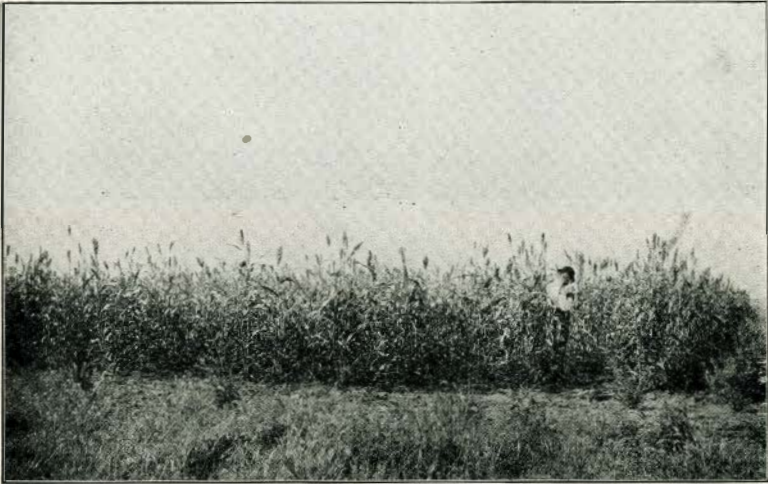


PLATE I.

PLAT B 13. WISCONSIN AMBER CANE.

Plat B (13).—Wisconsin Amber Cane (see Plate I). Drilled in rows 30 inches apart, May 9th. Sprouted and up May 15th; June 1st, 3 to 4 inches high; July 1st, 24 to 28 inches high. Damaged some by hot weather in July. Headed out August 10th. Some seed ripened September 1st. Cut September 16th. Yield in dried fodder 1450 pounds or 5800 pounds per acre, 2.9 tons.

Plat B (14).—Drilled to Brown Dhoura May 10th (see Plate II). Sprouted and up May 17th; June 1st, 2 to 3 inches high; July 1st, $2\frac{1}{2}$ to 2 feet high; September 1st, 3 to 4 feet high. Too thick in the rows. Cut September 16th. Yield 900 pounds or 3600 per acre.

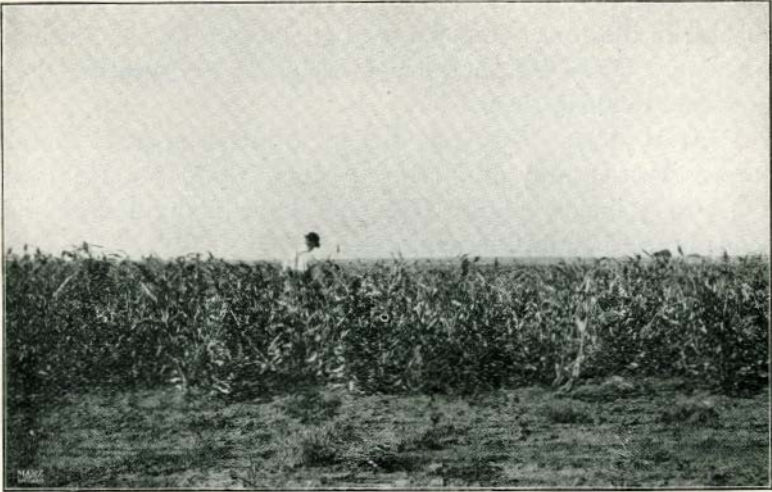


PLATE II.

PLAT B 14. BROWN DHOURA CORN.

Plat B (15).—Drilled in rows 30 inches apart, May 10th, to Jerusalem Corn (see Plate III). Seed raised here last year. Sprouted and up May 18th; June 1st, 2 to 4 inches high; July 1st, 20 to 24 inches high; September 1st, 4 to 5

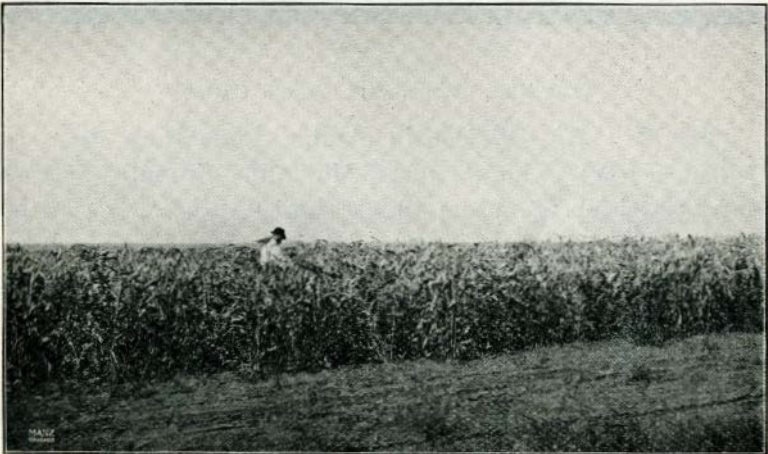


PLATE III.

PLAT B 15. JERUSALEM CORN.

feet high, headed out. Cut September 16th. Yield 1150 pounds or at the rate of 2.3 tons per acre.

Plat B (16).—18 rows on east side of plat. Yellow Milo Maize (see Plate IV). Drilled in rows 30 inches apart May 10th. Seed raised here last year. Sprouted up May 17th.

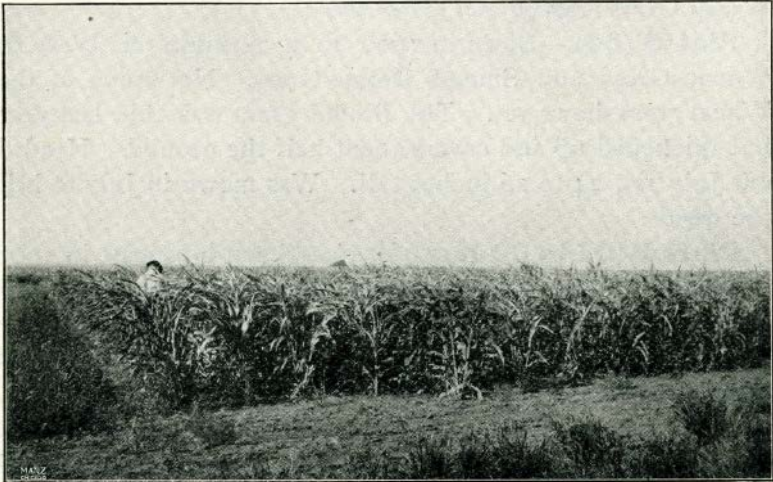


PLATE IV.

PLAT B 16. YELLOW MILO MAIZE.

June 1st, 3 to 4 inches high; July 1st, 18 to 20 inches high; August 1st, 30 to 36 inches high September 1st, 4 to 6 feet high. Cut September 16th. Did not head out this year. Very leafy and the best of the non saccharine sorghum tried here. Yield on $\frac{1}{8}$ acre 750 pounds or at the rate of 3 tons per acre.

Plat 8 (16).—14 rows on west side. Drilled on June 13th to Red Kaffir Corn S. S. P. I. No. 4810. Seed failed to grow.

Plat B (17).—Drilled May 13th to White Milo Maize. Seed failed to come.

Plat B (18).—Sown broadcast May 4th to *Bouteloua curtipendula*.

Plat B (19).—Sown broadcast May 4th to *Bouteloua oligostachya*.

Plat B (20).—Sown broadcast May 4th to *Agropyron divergens*.

Plat B (21).—Sown broadcast May 4th to Slender Wheat Grass (*Agropyron tenerum*).

Plat B (22).—Sown broadcast May 4th to Western Wheat Grass (*Agropyron spicatum*).

Plat B (23).—Drilled in rows 6 inches apart to Western Wheat Grass (*Agropyron spicatum*).

Plat B (24).—Sown in 1900 to a mixture of Western Wheat Grass and Smooth Brome Grass. Not much of the Wheat grass shows yet. The Brome grass was thin last year but thickened up and covers about half the ground. Headed out July 1st, 24 to 26 inches tall. Was mown in July to kill the weeds.

Plats B (25 to 30 inclusive).—Sown broadcast in 1900 to Smooth Brome Grass (*Bromus inermis*). Thin stand last year but thickened up this year so it covered about half the ground. Made a good growth and headed out 24 to 26 inches high. Badly infested with fine weeds, *Erigeron canadense*, and was mown in July. Came up well after being mown and grew during August and September. Stayed green until winter.

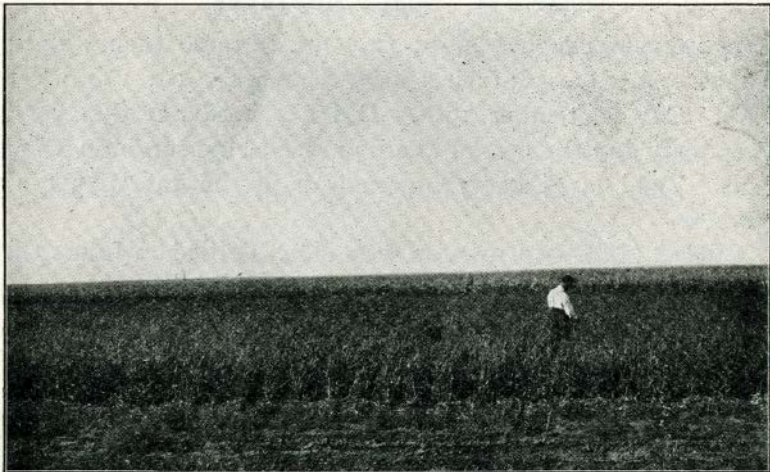


PLATE V.
PLAT C 22. JAPANESE BARNYARD MILLET.

Plats C (1 to 21 inclusive).—Sown June 8th to Common Millet to keep ground clean of weeds. Made good growth. One plat tested 20 bushels of seed per acre.

Plat C (22).—Drilled June 17th to Japanese Barnyard Millet (see Plate V). Sprouted and up June 25th. July 15th, 10 to 12 inches high; August 3rd, 1½ feet high; suffered from dry weather in July; August 24th, 2 to 3 feet high. Just beginning to head. September 5th headed out. Requires 90 days to ripen seed.

Plat C (23).—Drilled June 17th to White Broom Corn Millet No. 1387 S. S. P. I. Seed failed to grow.

Plat C (24).—West half. Drilled June 17th to Red Orenburg Millet No. 2960. Sprouted and up June 25th. Headed out August 3rd, 18 to 20 inches high. Ripe August 20th. Stood the dry weather very well in July.

Plat C (24).—East half. Drilled June 17th to Red Russian Broom Corn Millet No. 2797. Sprouted and up June 25th. Headed out August 3d. Ripe August 20th. Badly damaged in July.

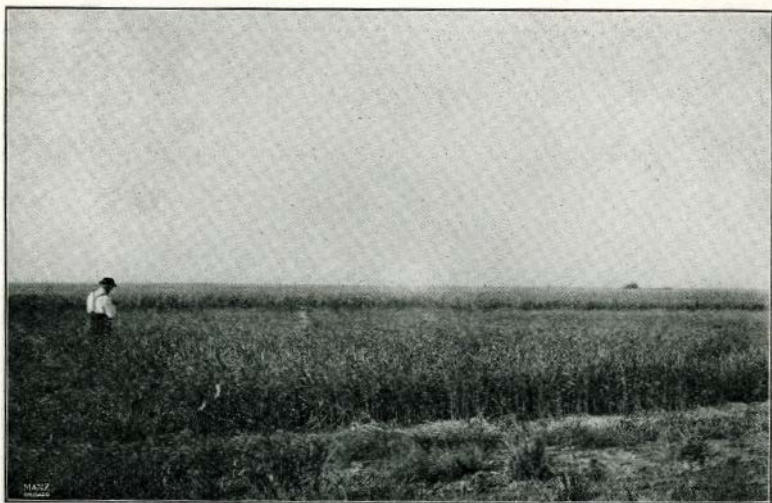


PLATE VI.
PLAT C 28. KURSK MILLET.

Plat C (25).—Sown June 17th to Tambov Millet No. 2794. Sprouted and up June 25th. Headed out August 3rd. Ripe August 20th. Dried up badly in July.

Plat C (26).—Sown broadcast June 13th to Red Russian Broom Corn Millet No. 1384 S. S. P. I. Sprouted and up June 20th. Headed August 3rd. Ripe August 20th. A little later than the Tambov, but dried out badly in July.

Plat C (27).—Sown broadcast June 18th to Red Veronezh Broom Corn Millet No. 2796 S. S. P. I. Sprouted and up June 18th. Headed out July 25th. Ripened August 5th. The quickest maturing millet tried here. Matured in 50 days.

Plat C (28).—Sown broadcast June 13th to Kursk Millet (see Plate VI). Sprouted and up June 20th. Headed out August 1st, 24 to 30 inches high. Ripe August 20th. Cut August 26th. Yielded 4 bushels seed at the rate of 16 bushels per acre. Stood the dry weather better than the common millet.

Plats C (29, 30).—Sown broadcast June 12th to Black Veronezh Millet No. 2795 (see Plate VII). Sprouted and



PLATE VII.

PLAT C 29. BLACK VERONEZH BROOM CORN MILLET.

up June 18th. Headed out August 3d, 24 to 28 inches high. Ripe August 18th. Cut and bound August 26th. One of the best to stand drought. Shelled badly before cutting.

The rest of the land plowed up was sown to millet or planted to corn to keep down the weeds.

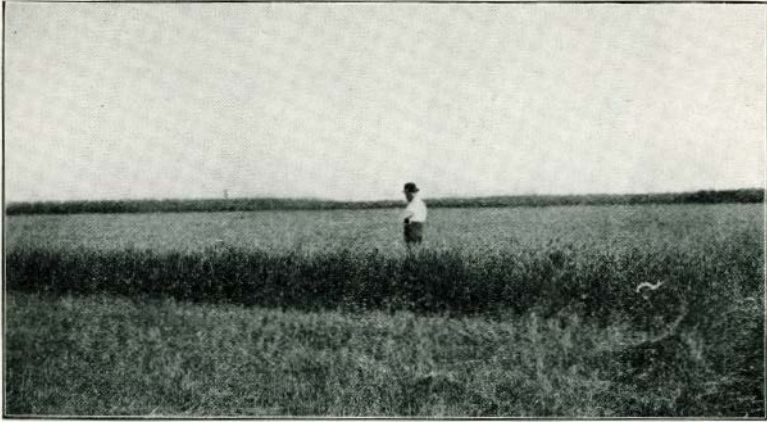


PLATE VIII.
PLAT C 1 TO 15. GERMAN MILLET.

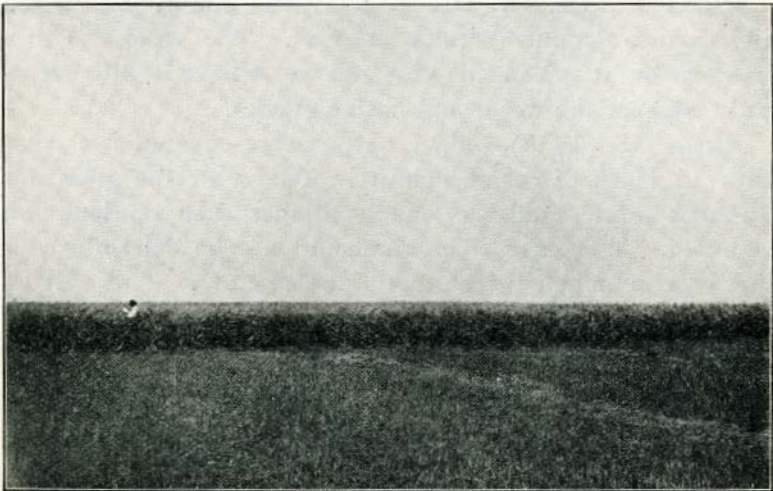


PLATE IX.
PLAT D 15 TO 30. SQUAW CORN, 4 TO 5 FEET HIGH.

Plats D (15 to 30 inclusive).—(See Plate IX). Were planted to Squaw Corn. Matured in 90 days.

Plats E (15 to 30 inclusive).—(See Plate X). Were planted to White Dent Corn. Matured in 95 days.

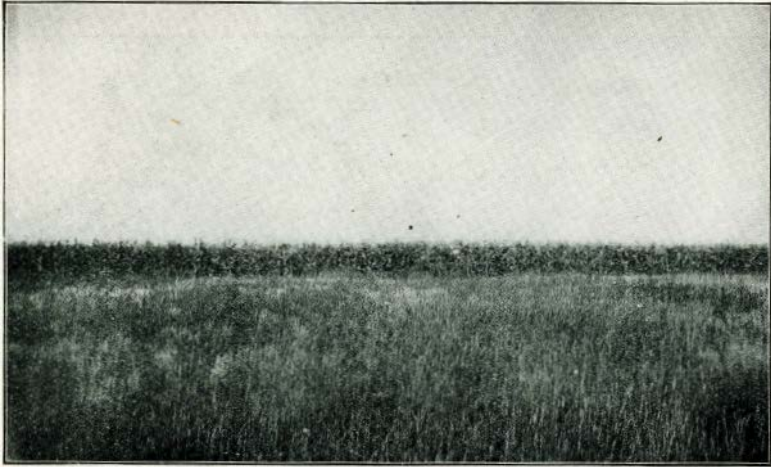


PLATE X.

PLAT E 15 TO 30. WHITE DENT CORN, 6 FEET HIGH.

Plats F (14, 15, 16, 17).—Were simply pulverized and sown to *Bromus inermis* last year. The stand was thin last year but it spread this year and we believe it will eventually conquer the weeds and native grasses.

Plats H (4, 5).—Two acres, were covered last year with 40 loads of coarse manure. This year the grass was 6 inches higher and very much thicker than on land not manured. The exact increase could not be determined as there was so much litter among the manure. This will be raked off in the spring and the ground harrowed smooth so the exact increase can be determined.

Plats I (6, 7, 8).—Were pulverized and sown to different grasses on the sod; were closely watched but none of the new grasses appeared. Pulverizing the ground increased the yield of the native grasses and more grass headed out than on the untreated prairie.