UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION

REED CANARY GRASS FOR MEADOWS AND PASTURES

A. C. ARNY, R. E. HODGSON, AND G. H. NESOM

REED CANARY GRASS PASTURE PROVIDED THIS HIGH PRODUCING HERD WITH THEIR SUMMER FEED

UNIVERSITY FARM, ST. PAUL

Fig. 1. Dense Mature Panicles of Reed Canary Grass Showing Variation in Shape

Note that the glumes of the spikelets are mostly erect, the glumes have spread and the seeds have fallen out. (Natural size.) At blooming time the branches of the panicles are nearly at right angles to the main stem. After the blooming period is over the branches take the more upright position shown in the figure.

REED CANARY GRASS FOR MEADOWS AND PASTURES

A. C. ARNY, R. E. HODGSON, AND G. H. NESOM[1]

Reed canary grass *(Phalaris arundinacea)* is comparatively new among the tame forage and pasture crops in Minnesota altho it grows wild in many parts of the state. Farmers, mainly in the south central part of the state, find that it fills a definite need for a high-yielding, nutritious hay and pasture crop on numerous comparatively small areas of low-lying, poorly drained lands mostly of a peaty or mucky nature, which have been bringing in practically no return. The success of reed canary grass in south central Minnesota on land too wet to produce other crops has led to the trial of the crop by farmers in other parts of the state and frequently questions arise as to its adaptability all over the state.

HISTORY

Reed canary grass grows wild in North America northward from New Jersey, Colorado, and northern California. In Europe, Asia, and Africa it is native to the temperate regions.

As a forage crop on cultivated lands, it was grown according to Piper (1924) in England prior to 1824 and in Germany as early as 1850. At present it is not grown as a cultivated grass in England but is utilized to a considerable extent in Germany.

In the United States the first known plantings of reed canary grass as a tame hay and pasture crop were made in Minnesota. Edward Schmidt of Mankato, Blue Earth County, purchased two pounds of seed from John A. Salzer Seed Company of La Crosse, Wisconsin, in the spring of 1899 and sowed on a low-lying, poorly drained peat area. From this area seed was gathered and hay cut until 1912 and since that time it has been pastured each season. The same spring Frank Young of Madison Lake, Le Sueur County, purchased seed from the same firm and planted it on a low-lying peat bog near the shore of Lake Washington. The crop on this field has been cut for hay each year since. From these original plantings has come the seed for the large number of fields in the two counties. The fields in Waseca County were established during the last few years from seed produced in Blue Earth County.

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In Oregon, J. W. Strong of Arago purchased in the spring of 1903 a pound of reed canary seed from the Charles H. Lilly Seed Company of Seattle, Washington. He sowed this on peat land. Mr. Strong sold his farm and moved away the same fall. Albert Fish, a neighbor still living at Arago, observed how well the small original planting of the reed canary did and gathered small amounts of seed for planting on his own farm. Since all of his land is peat, Mr. Fish wished to increase his acreage of reed canary more rapidly than the small amount of seed he could gather each year from the original planting would permit. In 1906, he ordered 100 pounds of reed canary seed from the Faribault Seed Company, now the Farmers' Seed and Nursery Company of Faribault, Minnesota, and sowed it on his farm. He gathered seed and increased his acreage until he now has 48 acres of this crop. It is estimated that 5,000 acres of reed canary grass are grown as a tame forage crop in Coos County, Oregon, mostly on peat land subject to repeated overflow from the Coquille River during the rainy season.

These three original plantings, still in first class condition, were made not from seed gathered from native stands but from seed imported from Germany.

Ribbon grass, a variety of reed canary grass with striped green and white leaves, is grown in many places as an ornamental plant.

ADAPTATION

In Minnesota at the present time, reed canary grass does not form an important constituent of the wild hay crop. The statement by Hitchcock (1914) that it forms one of the two important constituents of wild hay on marsh lands does not check with the facts. In the few small areas where it grows wild in the state, reed canary grass is usually found on low-lying, poorly drained lands on which water often stands in the spring and for short periods at other times during the year. It thrives in locations where the water table is practically at the surface of the soil all of the time and above the surface part of the time. Where stagnant water covers the land most of the time it does not grow successfully. It is also found in the beds and along the banks of shallow streams having started from seed carried by the water.

No other forage crop, seed of which is available in quantity at the present time, will thrive so well on highly productive lands that are too wet for most other crops. On such lands, which would otherwise bring low returns or none at all, reed canary grass has yielded hay and pasture as valuable or more so than the crops from equal areas of adjoining well-drained soils.

Altho reed canary grass has done well on the peaty and mucky lands near Mankato, it should not be inferred that it is adapted only to soils of this kind or that it will be equally successful on such lands in other parts of the state. Conditions may appear similar in different areas but trial often proves results unlike.

Reed canary grass appears to be well adapted to growing on well-drained mineral soils but here it must compete with a large number of other successful forage crops. Rindell (1908) mentions that reed canary grass appears to be well suited to growing on many kinds of soils. He cites an instance of a yield of 7.14 tons of hay per acre in three cuttings per season on stiff clay soil. Könekamp and König (1929) found that reed canary grass grew best where water stood nearest the surface of the soil. However, they found it able to send its roots deep into soils where water was farther down and gain in importance as compared with other grasses over a three-year period. Their work showed reed canary grass to be of exceptional adaptability to different soil and moisture conditions.

Yields of reed canary grass hay in comparison with those from other hay crops on well-drained mineral soil at Ames, Iowa, proved superior to timothy, brome grass, orchard grass, meadow fescue, and tall meadow oat grass (see page 21). In the Mankato district reed canary grass has spread in many instances to the higher lying areas of mineral land surrounding the peat bogs on which it was sown. It also grows vigorously along roadsides, having started from seed dropped from loads of hay. It is well adapted to wet mineral lands and should be a desirable hay and pasture crop on the mineral soils subject to overflow along the banks of the Minnesota and Mississippi rivers.

Until more information is available on the adaptation of reed canary grass in different parts of the state, as a matter of precaution, only a pound or two of seed, at the most, should be purchased and sown by each prospective grower in locations where it is not now being successfully grown. If the first small areas are successful when the best available information regarding seeding and handling the crop is followed, the acreage may be increased from home-grown seed.

Until the seed supply of reed canary grass becomes more adequate and lower in price, it appears advisable to sow most of it on low-lying, poorly drained lands and those subject to overflow where other crops do not usually thrive. Here reed canary grass may be left undisturbed for a long period of years and the best returns from the investment in seed obtained. In Germany it is on such lands that reed canary grass is of the highest value as reported by Weber (1928).

PLANT CHARACTERISTICS

Reed canary grass is a long-lived perennial, particularly when grown under favorable conditions. The plants are cold-resistant both as seedlings and in more mature stages. However, some plants may be killed when a covering of ice forms directly over the crowns.

The rapidly spreading, short, underground stems form a sod, which becomes so thick and tough after a good stand is established that ordinary hay-making machinery may be used without difficulty, where before it was planted animals could walk over the land only with great difficulty. The underground stems and the abundant root system of reed canary grass are shown in Figure 2. It is not difficult to get rid of reed canary grass by fall plowing, even after a thick sod has been formed.

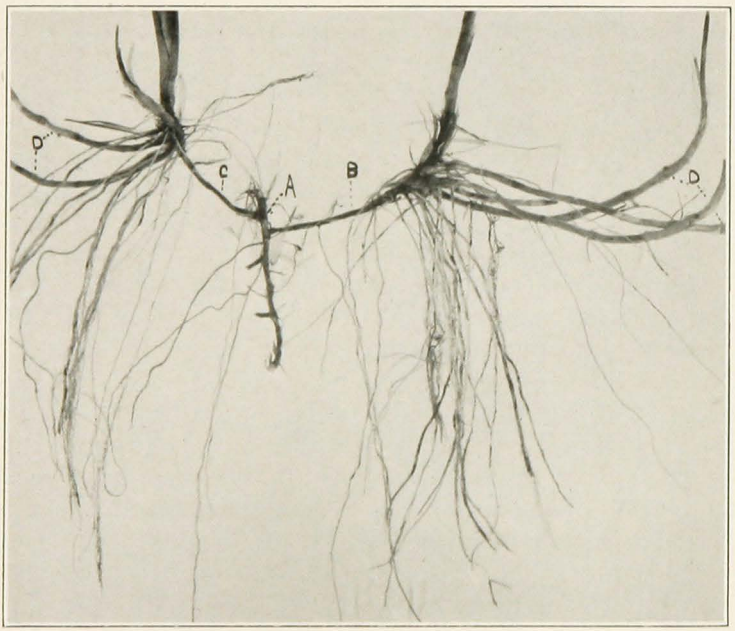


Fig. 2. Plant of Reed Canary Grass Showing Underground Stems
At A, what is left of an underground stem of the old plant from which B and C sprang. At D still newer underground stems with roots at some of the nodes.

Growth starts early in the spring, and, when moisture is abundant, continues throughout the summer and autumn. In from 8 to 10 weeks, or about the first week in June in southern Minnesota, the panicles begin to appear and about 4 weeks later the seed matures. In northern Minnesota the plants reach these stages of development 3 or 4 weeks later.

The plants grow from 4 to 6 feet high or higher, depending on the productivity of the soil and the moisture supply. The proportion of the stems to leaves becomes increasingly greater after the panicles begin to appear. Because of the strength of the stems, lodging of the first crop occurs only where the land on which it is growing is exceptionally productive. The leaves are broad, smooth to slightly rough, and light to dark green with the exception of the ribbon grass, the leaves of which are striped green and white.

At maturity the panicles vary in length from 3 to 8 inches and in width from ½ inch to 2 inches. There is considerable variation at maturity in the branching of the panicles on different plants. The panicles shown in Figure 1 do not include those of the most widely spreading type.

The glumes of the spikelets making up the panicles turn straw-color, in some cases with tinges of purple, and the seed matures while the stems and leaves are still green. The lowest leaves may turn yellow long before the seed is mature, due largely to the dense growth and shading by the leaves higher up. There appears to be considerable variation in different plants in this respect.

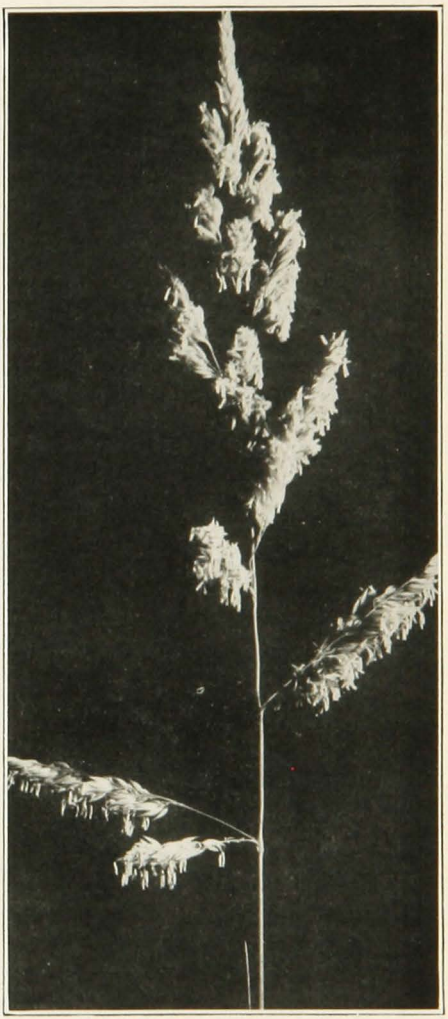


Fig. 3. Spreading Panicle of Reed Canary Grass at Flowering Time, Natural Size

The lower branches of the panicle are not erect but become more so after flowering. (See Fig. 1.) The stamens protruding from the florets are plainly visible.

A mature panicle is made up of a large number of more or less erect spikelets. A spikelet with the seed still in place is shown in Figure 4, B; and the two glumes of the spikelet from which the seed has fallen at A.

SEED CHARACTERISTICS

Mature seeds are somewhat similar in appearance to those of oats but are much smaller. A seed, 16 times natural size is shown in Figure 4, C. At maturity the hulls of the seeds are gray to brown in color, very shiny and slippery, like the seeds of flax. They vary from

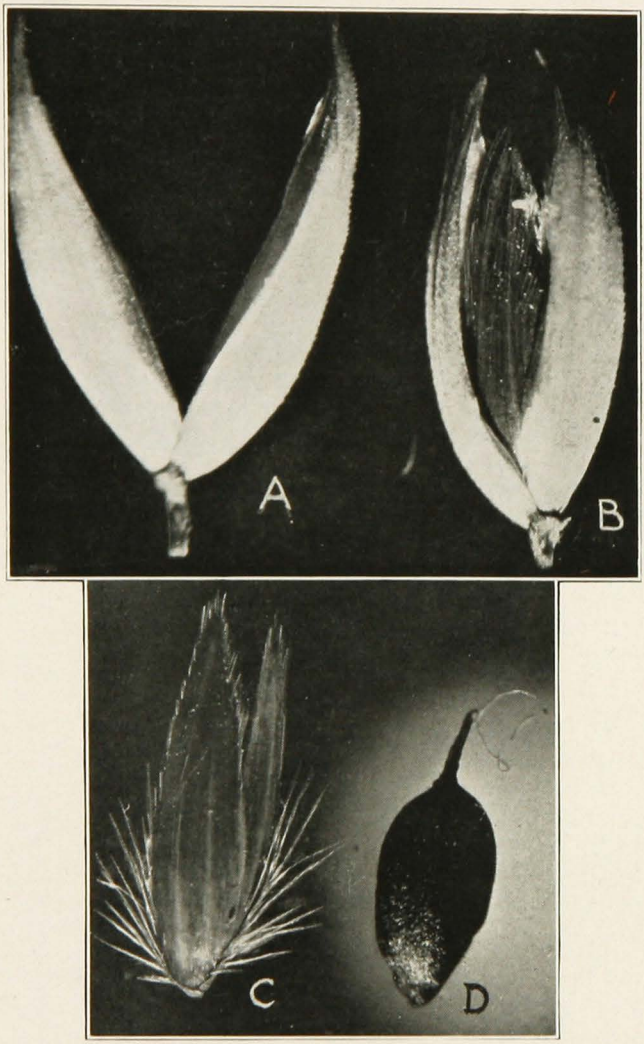
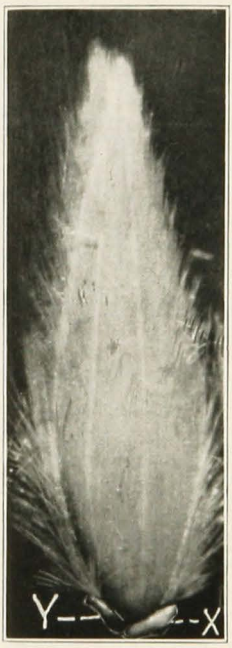


Fig. 4. A. Two Glumes of a Spikelet of Reed Canary Grass
B. A Complete Spikelet
C. Mature Seed
D. Naked Kernel, with Germ at Base at the Left

The glumes turn straw-color at maturity. The seed, gray to brown in color and sparsely covered with long hairs, is still within the glumes, which have not opened. The mature seed resembles a gray to brown oat kernel. The two hairy scales, approximately one-third the length of the hulls, are shown, one on each side, in C. All are approximately 16 times natural size.

sparsely covered with long silky hairs that give the seed a soft, fluffy feel, to almost free from hairs. After much handling of the seed most of the hairs may be broken off. At the base of each seed, two awl-shaped scales are attached that extend upward about one half and one third of the length of the seed, respectively. These may be covered with long hairs or nearly smooth. They can be seen easily on each side of the seed at C, in Figure 4. Each of these awl-like scales is enlarged somewhat at its base, which is free from hairs, as shown in Figure 5, and has a slightly corrugated surface. These enlarged portions form one part of each of the joints by which the seeds are firmly attached to the parent plant until near maturity. These joints separate easily at maturity and the seeds lie loose between the glumes until the spikelets are tipped to one side when the majority of them fall out.



The seeds are small, 7 to 8 placed end to end measuring one inch. Mature reed canary grass seed ranges from 425,000 to 600,000 per pound, and if there is considerable light-colored immature seed, there may be 700,000 or more. The weight per measured bushel of mature, well-cleaned seed of the 1928 and 1929 American crops, ranged from 28 to 35.5 pounds. Imported seed of the 1928 crop ranged from 29.2 to 34.1 pounds per measured bushel. Both Piper (1924) and Schoth (1929) give the weight per bushel as 44 to 48 pounds, which is too high. This varies with the plumpness of the seed and the thoroness of the grading. Removal of the light-weight seeds not only raises the bushel weight but also the germination percentage.

Fig. 5. Side View of a Reed Canary Grass Seed Enlarged 24 Times, Showing the Enlarged Bases of the Two Awl-like Scales at X and Y

The base of the scale at X usually overlaps the end of the base of the scale at Y. These enlarged portions form one part of a joint which holds the seed firmly attached until the approach of maturity. As the parts dry out when the seed is mature, the joint is released and the seed lies free between the glumes.

GROWING THE CROP

Sources of Seed

For a number of years prior to the World War, seed of reed canary grass imported from Germany was offered for sale by a few seed houses in Minnesota and Wisconsin. This was the source of seed for the first plantings of the crop in Minnesota, and the Oregon stands are largely from the same source. Seed in quantity continues to be

available in Germany but during the last few years only limited amounts of it have been imported. Small amounts of seed were gathered by hand from the first fields established in Minnesota and Oregon to increase the acreage. The seed was gathered by hand either by the owners and sold locally or neighbors who were invited in to gather the small amounts they needed to get a start. This method of gathering the seed and disposing of small surpluses has made it high priced and has not provided commercial stocks.

In 1928 approximately 500 pounds of seed was harvested in Minnesota with a machine adapted to the purpose. This was sold at from $1 to $1.75 per pound and did not begin to meet the demand. Another machine was adapted to this purpose in 1929 and the 1928 machine modified to make it more efficient. As a result approximately 3,000 pounds of seed were harvested in 1929. All of this seed is of high quality, germinating 80 to 90 per cent or higher. A considerable portion of this has already been sold both to seed houses and direct to farmers at the 1928 prices. As machines come to be used more generally to gather the seed, some reduction in the price may be expected.

More seed was gathered in Oregon in 1929 than previously. This seed is also of high quality. If the supply of native grown seed proves inadequate, seed produced in the Pacific Coast states can be used with satisfactory results.

All reed canary grass should be purchased on a guaranteed germination test made in a state seed laboratory.

Securing a Stand

Where low-lying land is well enough drained so that a good seedbed can be prepared, that method is best. Less seed per acre is required on a well-prepared seedbed. This is important at the present price of seed. Starting the preparation of the seedbed by plowing the ground in the fall makes it possible to seed earlier in spring. If difficulty in getting on the fields in the early spring is anticipated due to standing water the plowed surface may be worked down well in the fall and the seed sown in October. If sown late in the fall, the seed will lie in the ground until spring without germinating. It is then ready to germinate as soon as conditions are favorable. The seed germinates readily in water, but when covered with soil underneath water, does not germinate until the water has disappeared. If water does not stand on the ground too long in spring, the seedbed may be prepared and the seed sown in the spring.

Where large numbers of broad-leaved weeds will grow rapidly, reed canary grass should be sown either as early in spring as possible so the seedlings may be well established before the weeds begin to grow or the seeding should be delayed until the weeds have been largely killed by cultivation. The seedlings of reed canary grass are

as hardy as those of timothy and similar grasses, hence there is little danger of loss by freezing after growth has started. Where weedy land makes early seeding impractical, it may be delayed until the last week in June or the first part of July. This gives ample opportunity to plow the land in the spring if it has not been fall plowed and to disk the land throughout the spring months in order to kill out the weeds before the seed is sown. When the seed is sown as late as the last week in July, the ground is not completely covered with sod the first year, unless more seed is used per acre than is economical at present prices. An average clump developed from a single seed planted early in July, 1928, on moist peaty land and photographed in November is shown in Figure 6.

Another method, on small areas, is to sow the seed in drill rows so that the weeds can be killed by cultivation. This has the further advantage of requiring less seed per acre than the broadcasting method.

Bogs that are too wet to bear up horses and machinery during the open season of the year and are not covered with water in the spring may be burned over either in fall or early spring to free the surface of all previous growth that hinders in the preparation of the seedbed and in establishing a stand. The burning should be done when the grass is dry and a brisk wind blowing so the fire will pass over the field quickly and make a clean burn. Where there is danger of burning peat land, attention must be given to places where fire starts in it, as soon as the surface has been burned over. In spring as soon as 3 or 4 inches of the surface is thawed out but is frozen underneath enough to bear up horses and machinery, the disk should be used to smooth the surface and work up a fair seedbed. Even if the land is wet, this practice levels the surface and makes conditions more favorable for the germination of the seed and the establishment of the plants.

Where old reed canary grass stands are available, sods 3x3 inches or even smaller may be dug in spring and planted 2 feet apart in the new location. Planting the sods 2 feet apart or less is preferable to a greater distance. Where no seedbed can be prepared, this method is more certain of results than that of sowing seed. Burning the land off clean facilitates planting the sods in spring and gives them a better chance to become established. This method of obtaining a stand involves no outlay for the purchase of seed. Where there is a good seedbed and other conditions are favorable, the sods planted about 2 feet apart each way in spring may result in a fairly complete covering of the ground by fall.

Rate, Method, and Depth of Seeding

At the present high price of seed, it is much more economical to broadcast from 4 to 6 pounds or drill 2 to 3 pounds per acre in 16- to 18-inch rows and let the sod form more slowly through growth of

Fig. 6. A Clump of Reed Canary Grass 6 Inches in Diameter Developed from a Single Seed Sown on Moist, Highly Productive Land July 16, 1928
(Photographed in November.)

Many of the clumps from single seeds were larger than this. The extensive vigorous feeding root system is shown below the main part of the clump.

the underground parts than to sow at a higher rate. Growth of the plants in cultivated rows is usually somewhat more rapid than in broadcasted seedings. When germination is low, more than these amounts must be sown; and more must be sown on poorly prepared than on well-prepared seedbeds. When reed canary grass seed becomes lower in price, more seed per acre can be used to advantage. Four pounds of seed germinating 80 per cent or better, sown evenly over an acre, means at least 40 good seeds per square foot. Reed canary grass seed may be sown along with a grain crop wherever such crops can be grown to advantage. Lodging of grain will often kill out the seedlings of reed canary grass.

The seeds of reed canary grass and the seedlings are small. Therefore covering of the seed from less than half an inch to three fourths of an inch is ample. On peat lands, the use of a heavy roller after the seed is sown firms the surface and provides better conditions for germination and growth.

Care after Seeding

If a thick stand of broad-leaved or other quick developing weeds is growing more rapidly than the reed canary grass seedlings, the weeds should be clipped back. This gives the weeds a setback and the reed

Fig. 7. Hummocks Like This So Common in Bluegrass and Redtop on Wet Land Pastures Are Absent in Reed Canary Grass Pastures Provided the Sod Is Well Established Before Cattle Are Turned on.

canary grass an opportunity to outgrow them. Where the reed canary grass is drilled in rows, some cultivation can be given until the plants become well enough established to compete successfully with the weeds.

There is a distinct advantage in favor of planting in rows particularly on weedy lands. Reed canary grass should not ordinarily be pastured at all the season it is sown. If a luxurious growth is made on spring seedings, it may be cut high as hay in preference to using it for pasture. On wet lands, newly established stands of reed canary grass should not be grazed by cattle or horses until a firm enough sod has been established so they will not cut through. Maximum pasture and hay crops are not produced until after a good sod is established.

When the first crop the year following planting makes enough development so that it will produce seed, this may be left to mature and fall to the ground in order to help to thicken up the stand. The seed that falls to the ground, even when careful harvesting methods are employed, is considerable and it generally germinates and grows the same season.

Reed canary grass needs the same fertilizers as other grasses on the same land.

UTILIZING THE CROP

After a good reed canary grass sod is formed, animals do not sink in fields that were difficult to traverse before and ordinary hay making machinery may be used without difficulty.

Pasture

Reed canary grass starts early in spring, even before the water which may cover it disappears, and continues growth later in fall than some other grasses. Where the necessary plant foods are abundant and the water in the soil is adequate, it produces an abundance of pasturage throughout the entire growing season. When Kentucky blue-grass pastures on high lands are often dry during August, this grass on low lands continues to furnish large amounts of pasturage. Its use for pasture lengthens the grazing season.

Records of the carrying capacity per acre of reed canary grass pasture are not numerous but check fairly well. Schoth (1929) reports in Oregon where the sod is well established on lands where the moisture supply is abundant and other conditions are favorable, pasture was provided for four mature dairy cows per acre for seven months each year. McCollam (1929) advises close grazing to keep the grass from becoming old and tough. In Minnesota a stand established 31 years ago, cut for hay a number of years and pastured for the last 17 years, has at present a smooth even sod and provides good grazing. (See Figure 8.) A large percentage of the growers of this crop in the Mankato district have used it successfully for pasture for varying periods of time but records of carrying capacity are not available.

Hogs relish reed canary grass, especially if it is kept grazed fairly short. It is being used for hog pasture in the Mankato district. Where the number of hogs per acre is relatively large, it is necessary to ring them to prevent them from uprooting the sod.

Fig. 8. Horses Grazing on One of the Two Original Seedings of Reed Canary Grass Made in Minnesota in 1899

This field was sown by Edward Schmidt, Lime Township, Blue Earth County. It was cut for hay for a number of years but has been pastured for the last 17 years.

Hay

Seed of reed canary grass is produced in quantity only on the first growth of the season. Up to the time the panicles begin to appear, approximately the first ten days of June in southern Minnesota, the crop is comparatively fine stemmed and leafy. With the appearance of the panicles, the stems elongate well up to the time the first seed is mature or approximately the last of June. The stems may double in length during this short period and at the same time they become more fibrous. The second and third crops do not produce panicles in any numbers. Hence, the hay of these crops does not become stemmy and resembles that of the first crop at the time the panicles begin to appear.

Growers who wish to harvest seed crops must necessarily let the crops stand until the seed has matured. As soon as the seed has been gathered, the hay crop should be cut. Each day of delay in getting this crop off the fields holds back the second crop by that much. Cut at this stage of maturity, large yields of comparatively coarse hay are obtained.

When hay is the only product desired, there is a wide choice as to stage of development to cut the first crop of the season. The choice

should be influenced to the greatest extent by yield, composition of the hay, and its palatability. However, there are other considerations. Reed canary grass has a higher water content before and at the time the panicles begin to appear than it has when all the panicles are out or later. This makes some difference in the ease of drying the hay. Other pressing farm work during the period when reed canary grass can be cut for hay to advantage must be given consideration. The later the stage of maturity at which the first crop is removed, the more the development of the second crop is delayed.

Fig. 9. Reed Canary Grass on the Meadow Sown by Frank Young on the Shores of Lake Washington, LeSueur County, Minnesota, in 1899

This is one of the two original seedings in the state. It has been cut for hay each year. First cutting, 1929 crop, yielded 3.63 tons and second cutting, 0.94 tons or a total of 4.57 tons of hay per acre. Photographed July, 1929.

Part of the data obtained in the Mankato district during the summer of 1929 is now available and is presented in Table I, page 18.

In considering the yield data it is well to remember that they came from a limited number of peaty or mucky fields in a single district of the state and are for one season only. For this reason no final conclusions can be drawn.

Dry matter content of the green material was lowest, 22.4 per cent, on June 8 and increased steadily until the seed was mature when it was 29.6 per cent.

The yields of hay per acre increased slightly over half a ton during the 10-day period between June 8 and 18, and there was a further increase of nearly a ton per acre up to June 30. From this time on there was only a slight falling off in yield to July 21. Farmers in this section are of the opinion that the growth of the first crop in 1929 was not as

great as in previous years. Second crop reed canary hay averaged 1.92 tons per acre. These yields must be considered along with the composition of the hay and other factors in deciding at which stage of maturity to cut the first crop.

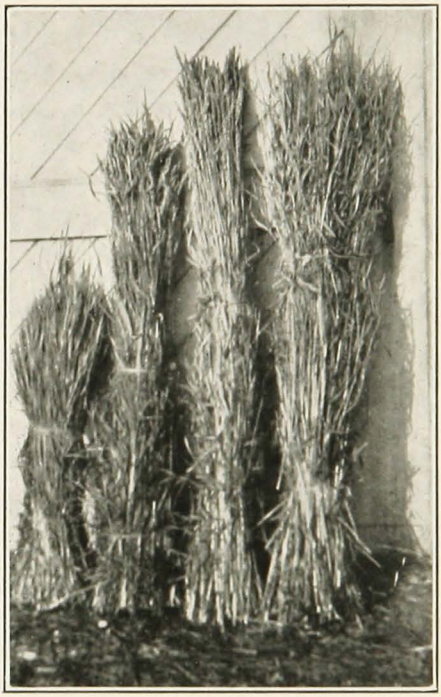


Fig. 10. Hay Samples (Left to Right) Cut June 8, June 19, June 30, and August 28
The crop cut June 8 is leafiest and highest in crude protein but lowest in yield. It is similar in appearance and composition to second crop hay.

COMPOSITION OF REED CANARY HAY

Unfortunately the majority of the analyses of reed canary grass hay available up to the present time have not been helpful in deciding on the stage of maturity at which the hay should be cut.

Henry and Morrison (1928) give the crude protein content of reed canary hay as 7.9 per cent on a 9.6 per cent moisture basis as compared with 13.1 per cent for red clover hay on a 13.9 per cent moisture basis. The stages of maturity of the ten samples on which the composition is based are not given.

Rindell (1908) gives the crude protein content of reed canary grass hay cut 10 days before flowering as 10.5 per cent on a 15 per cent moisture basis and that of red clover hay as 12.3 per cent on a 14.3 per cent moisture basis.

Percentages and pounds per acre of crude protein for a part of the hay harvested at different stages of maturity during the summer of 1929 in the Mankato district are given in Table I. The samples analyzed were dried without exposure to rain or dew. Hay bleached in drying has a distinctly lower crude protein content.

The yield of 1.10 tons of hay per acre obtained on June 8 as given in Table I had a crude protein content of 13.99 per cent and the yield of crude protein per acre was 312.6 pounds. The 1.66 tons of hay per acre from the June 18 harvest was 1.62 per cent lower in crude protein than the previous yield but the total amount of crude protein per acre was higher by 94.3 pounds per acre. At this stage of development the hay harvested on this type of land has approximately the crude protein content of average red clover hay. There was a further increase of nearly a ton per acre of hay to June 30 accompanied by a further decrease in the crude protein content of 1.26 per cent but a much higher yield of crude protein in pounds per acre. The hay harvested on dates later than June 30 was slightly lower in protein content and yield of protein per acre. Timothy in the early to full bloom stage has 6.3 per cent and nearly ripe timothy hay has only 5.2 per cent crude protein according to Henry and Morrison (1928). These comparatively high crude protein contents of reed canary hay cut at the time the seed was mature and after that do not confirm the statement by Weber (1928) that harvested in bloom or later it has only the feeding value of straw.

TABLE I

AVERAGE YIELDS OF REED CANARY HAY PER ACRE, CRUDE PROTEIN IN PER CENT AND POUNDS PER ACRE CUT AT DIFFERENT STAGES OF MATURITY IN THE MANKATO DISTRICT

Stage of maturity when cut	Date cut	Height	Dry matter at cutting	Hay per acre	Crude protein	Crude protein per acre
				On a 15 per cent moisture basis		
First cuttings			per cent	tons	per cent	lbs.
None to 8 per cent panicles showing	6/8	20	22.4	1.10	13 99	312.6
50 to 100 per cent panicles showing	6/18	45	25.4	1.66	12.37	406.9
Seeds at tips of panicles ripe.....	6/30	50	27.8	2.58	11.11	573.2
All seed mature.....	7/7&7/9	50	29.6	2.48	10.98	525.8
All seed shattered	7/15	50	28.4	2.41	10.88	524.4
All seed shattered	7/21	50	26.9	2.38	10.84	516.0
Second cuttings						
From fields cut the first time on June 30	8/27	26	27.8	1.92	12.11	468.9

The crude protein content of the second crop reed canary hay averaged 12.11 per cent and the yield of crude protein was 468.9 pounds per acre.

Considering only yield and quality of hay for feeding to dairy cattle, it appears desirable to harvest the first crop of reed canary grass be-

tween the time the panicles begin to appear and the time the majority of them are out. This results in a medium yield of hay high in crude protein content and with a palatability very similar to second crop hay. Harvesting the first crop during that period has the further advantage of giving the second crop an early start with the possibility of obtaining a third crop or considerable fall pasture after the second cutting has been removed. Harvesting the first crop as early as this often has the disadvantage that it competes for labor with corn cultivation.

Growers who are able to utilize the first crop of hay largely for feeding to work horses and the second crop for dairy cows, may find that it fits in better with their work to cut the first crop a few days before the seeds in the tips of the panicles mature, which in southern Minnesota is during the last week in June or the first of July. Except when seed is to be gathered, there is nothing to be gained by putting off the hay harvest longer than this. Reference to Table I shows that the hay from the harvests later than June 30 dropped off some both in yield and in protein content. Observations indicate that the hay was coarser, which makes it less palatable.

Second and third crop hay should be cut as soon as it has ceased making comparatively rapid growth. In the Mankato district in 1929 the second crop ranged in height from 24 to 30 inches during the last week in August on fields from which the first crop was removed during the last of June. On fields where the removal of the first crop was delayed, the second crop was correspondingly late.

Grass hay, produced on soils above the average in available nitrogen, should be higher in protein content than those produced on soils of average nitrogen content or lower. Some of the low-lying fields from which the data given in Table I were obtained may be higher in available nitrogen than the average well-drained mineral soils. At present there are no analyses of hay grown on average mineral soils available for comparison.

Nitrogen fertilizers were applied at rates of 160 and 320 pounds per acre to parts of one field in the Mankato district in May, 1929. The crude protein content of the hay from the untreated portions cut on July 15 was 10.88 per cent and from the portions treated with 320 pounds of nitrogen fertilizers, 12.86 per cent. For the second crop cut September 5 on the untreated portions, the crude protein content was 12.79 per cent and the treated portions 14.25 per cent. These percentages are for hay on a 15 per cent moisture basis. The data for the hay from the nitrates applied at the 160 pounds per acre rate are not available at present. These results are in line with numerous previous findings that applications of nitrates made at the proper time usually increase the protein content of grass crops.

PALATABILITY AND FEEDING TRIALS OF THE HAY

Farmers who have been feeding reed canary hay cut before it became too coarse have found it palatable to all classes of livestock.

At the Southeast Experiment Station, at Waseca, good second crop reed canary hay was as palatable to cattle, after they became accustomed to it, as good timothy and was superior to wild hay. It was less palatable than alfalfa hay.

The following results were obtained from comparative feeding tests of good second crop reed canary hay, timothy, wild hay, and alfalfa hay.

The cows used in the trial always have had an abundance of good alfalfa. No other hay has been fed. Group I consisted of four cows producing an average of 25.2 pounds of milk per day. They were eating from 13 to 14 pounds of alfalfa each, daily.

When well-cured, second cutting reed canary hay was substituted for the alfalfa, they consumed only 5.7 pounds per day. Other feeds were held constant, and the consumption of hay increased steadily, so that after three weeks the cows were eating 11 pounds of the reed canary hay. This was about the same bulk as their usual ration of alfalfa.

Milk production dropped gradually after the change in hay until the average was from 3 to 3½ pounds per day less than when alfalfa was fed; there was no increase in the first 10 days after the feeding of alfalfa was resumed.

Four other cows, forming Group II, were eating about 12 pounds of alfalfa per day each. When reed canary hay was substituted, they ate less than 6 pounds. They, too, ate more as they became accustomed to the change, eating more than 8 pounds per day at the end of a week. When choice, early cut timothy was substituted for the hay under trial, each cow ate an additional pound per day.

After a week on timothy, wild slough hay was given, and consumption decreased. When alfalfa was restored to the ration, the amount of hay consumed daily went back to normal.

In milk production the cows of Group II dropped about the same as those of Group I on reed canary hay, more on timothy, and still more on wild hay. No further loss in milk production occurred when alfalfa was again used in the ration. The total reduction was about 4½ pounds per cow daily.

Group III, fed alfalfa throughout the test period, varied only 2 pounds of milk per day in the same period.

This brief trial indicates that the cows did not like a sudden change from alfalfa to reed canary hay. They ate only half as much at first and their production dropped. Gradually they ate more of the hay

but not enough to keep up the milk flow maintained on alfalfa. Whether this was due to the change in hay or to lack of food nutrients is not known. The crude protein content of the second cutting reed canary hay used in the trial was 12.7 per cent. Further feeding tests are planned for the winter of 1929-30.

Results to date of growing and feeding tests conducted at the Iowa Experiment Station at Ames, Iowa, mainly on upland fields have been summarized by F. S. Wilkins (1929) for inclusion here as follows:

"Seed increased from the original small packet received from an Iowa farmer in the fall of 1918 has been used in various cultural and palatability tests. Seedings made in 1922, in both upland and bottom land blue grass pasture, still persist and apparently produce a good grazing quality.

"The reed canary grass has been grown on upland soil, below the average in fertility, in comparison with better known grasses. Seedings were made in quadruplicate in the spring of 1924 with reed canary grass, timothy, smooth brome, red top, tall meadow oat grass, orchard grass and meadow fescue. As an average for the three years, 1925 to 1927, inclusive, the reed canary, with a yield of approximately 2¼ tons per acre of cured hay, produced approximately 50 per cent more than even the best of the other grasses.

"The results secured on this upland soil in 1927 are of particular interest, since, according to official records, rainfall for the season was particularly deficient, even sudan grass on this field making only half its normal production. However, in spite of the known adaptation of the reed canary grass to low, fertile undrained soil, the yield under these apparently very adverse conditions was approximately three tons per acre or nearly twice as much as that of brome grass, which was second in yield.

"Reed canary hay, harvested 10 days after the seed was ripe and fed to a group of brood mares in comparison with good quality timothy hay, was consumed to the last straw when timothy was hardly touched. One of the apparently desirable characteristics of reed canary grass is that it retains its leafiness and apparent succulence long after the seed ripens."

SEED PRODUCTION

From the data given in Table I, it is evident that the yield of the first crop of hay in tons and protein in pounds per acre of reed canary grass increases about up to the time the seed begins to ripen and the percentage of crude protein decreases only moderately up to that time. Therefore, farmers who are equipped to harvest and care for the seed can increase their profits by gathering it from the first crop before cutting for hay. Even with seed at one-third its present price of $1.50

per pound, this practice appears to offer the opportunity to increase income per acre.

The seeding habits of reed canary make it difficult to harvest large amounts by hand. Maturing of the seed in the panicles is progressive. When the first seeds at the top of the panicles of reed canary are mature, as indicated by the hulls being fully colored gray or brown like A, Figure 11, others lower down range in amounts of color present down to that shown by D, which has only a trace. Still more immature seeds are entirely green and others lack the green color entirely, like E.

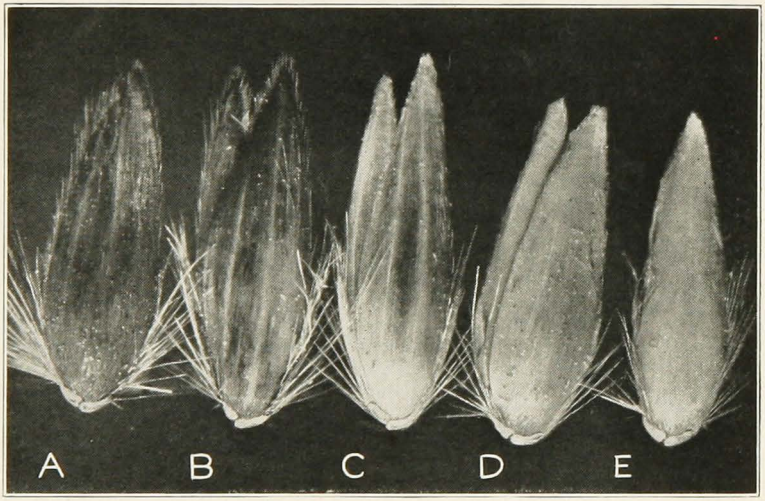


Fig. 11. Reed Canary Seeds 16 Times Natural Size Removed from a Single Panicle when First Seeds Were Mature at the Top

A shows fully mature seed with the hulls entirely brown or gray in color. B and C seeds have less gray and brown color in the hulls than A and are less mature. D and E have little and no gray color in the hulls, respectively, and are too immature to make good seed.

The germination percentages and other data for seeds with varying amounts of color in their hulls are given in Table II. The first mature seeds drop out and are lost before the rest are far enough advanced to harvest. As a result, there are only a few days between the ripening of the first seeds and the time when too many have fallen to make it worth while to continue gathering the panicles. This necessitates watching the crop closely during the latter part of June and the first days of July when the panicles begin to change color, and harvesting, either by hand or machine, when the largest amount of mature seed can be secured.

When to begin gathering the seed crop depends on how rapidly the work can be completed. If gathered by machine and the acreage is not too large, it probably is best to wait until the seed in the upper

half of the panicle is gray to brown in color. If gathered by hand, it may be advisable to start a day earlier. On a field where daily harvests were carried out on a series of plots in 1929, yields of more than 100 pounds of seed per acre were obtained over an eleven-day period starting when the first seeds were ripe at the tops of the panicles. The highest yields per acre were 163.3 and 160.3 pounds per acre on the third and fourth days of the eleven-day period. A heavy rain accompanied and followed by winds during the night of the eleventh day resulted in a yield of only 37 pounds per acre on the twelfth day. The period over which good yields can be secured is governed by location of fields and weather conditions. Strong winds cause rapid loss of mature seed from the panicles and if accompanied by rain the loss is hastened.

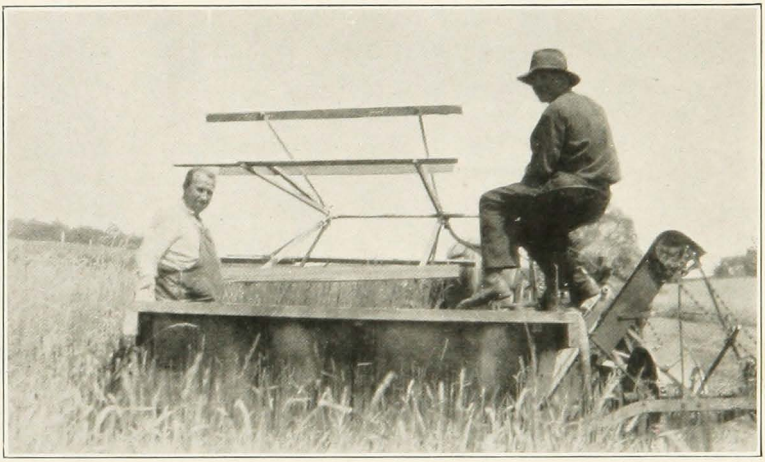


Fig. 12. A Machine Harvesting Reed Canary Grass Seed
Everett Berndt and Hugo Roemhildt of Elysian constructed this header to harvest seed rapidly in 1929. Alfred Miller of Janesville operated a similar machine in both 1928 and 1929.

One method followed in gathering the seed by hand is as follows: A wooden or wire hoop from a keg or barrel is fastened inside at the top of a wide, tightly woven canvas bag. Canvas straps are attached so the bag can be suspended over the neck at the proper height and the panicles can be dropped in easily as they are cut with a hand sickle. Closely woven canvas is necessary so the slippery seeds will not work through the bag.

As the panicles are grasped, cut off, and placed in the bag, care should be taken to keep them strictly upright so that as many of the mature seeds may be secured as possible. As the bag is filled, the contents are either emptied on a closely woven canvas or into a wagon box that is tight enough to retain the loose seeds as well as

the panicles. The panicles and the loose seed are then spread on a tight floor in a well-ventilated place where there is no wind, and are turned several times daily to facilitate drying.

Gathering the panicles by machine is a much more rapid process. When the large hopper of the machine shown in Figure 12 is filled with the panicles, they are transferred to a wagon having a box rack lined with canvas in which they are hauled to the drying sheds. In 1929 a grower in the Mankato district cut two acres of reed canary grass with the binder for seed and threshed it with an ordinary threshing machine. He reports 125 pounds of seed per acre. However, considerable of the seed had the hull removed and the germination was low.

The practice has been to follow the binder immediately with the mower going around the field in the opposite direction. If there is a shortage of help, the cutting of the hay may be deferred until the seed harvest has been completed but should not be delayed beyond that time.

Harvesting the panicles when the first gray to brown seeds appear results in reduced yields, made up of too large a proportion of light colored seeds and low in weight. Seeds that were straw colored, light green, or had only a slight amount of gray or brown on the hulls, were separated from samples of the 1928 crop and weighed in comparison with seeds from the same samples having the hulls entirely gray or brown (Arny, et al. 1929). The light colored seeds weighed only 68.6 per cent as much as the matured ones. The average germination of the gray seeds was 86 per cent and of the partly gray, 65 per cent.

In another test in which seeds of two lots of the 1928 crop, harvested at the usual time and not cleaned or graded, were separated into groups according to amount of gray or brown on the hulls, the average results were as follows:

TABLE II

MATURITY, WEIGHT PER 1000 SEEDS, AND GERMINATION PERCENTAGES OF REED CANARY GRASS SEED*

Color of hulls	Seeds of the various grades of color present	Weight per 1,000 seeds	Weight per 1,000 seeds	Germination, 16 days
	Per cent	Grams	Per cent	Per cent
Entirely gray or brown, Fig. 11, A.....	48.5	0.865	100.0	91.0
Down to 75 per cent gray or brown, Fig. 11, B	23.5	0.775	89.8	83.5
Down to 50 per cent gray or brown, Fig. 11, C	13.2	0.691	79.9	83.0
Down to trace gray or brown, Fig. 11, D	8.2	0.574	66.4	72.5
Entirely green	4.1	0.452	52.3	51.5
Trace of green, Fig. 11, E.....	2.5	0.358	41.4	36.5

* See Figure 11.

From these data it is evident that the more mature the seeds, as evidenced by the amount of gray or brown color on the hulls and the plumpness as indicated by weight per 1,000 seeds, the higher the percentage of germination. In these samples, 93.4 per cent of the seeds has a trace or more of gray or brown on the hulls when harvested. All germinated more than 70 per cent. The data show that seeds entirely green or with only a trace of green in the hulls harvested at the same time as the more mature seed may be expected to germinate from 30 to 50 per cent. As long as the price of seed remains high, those with green hulls separated from the others in preparing the seed for market may be used to advantage for increasing the acreage at home. Indications are that more than twice as much, by weight, of this seed should be used per acre as of mature seed.

Drying the Seed

When the seed is harvested either by hand or with the binder, considerable amounts of stems and leaves are included. As the stems, leaves, and panicles have a higher water content than the seed they cause much of the difficulty in the drying process. However, small amounts of the harvested material may be handled very satisfactorily by spreading on canvas in the sun for a day or two, turning frequently and removing to cover during the night. After this treatment the seed can be beaten out and the panicles discarded. The seed can then be spread in a thin layer on canvas and exposed to the sun for several days until dry enough to store in bulk without heating.

The method used for larger amounts is to spread the panicles 6 to 8 inches deep on canvas or other material under cover and turning about 6 times a day to prevent heating. When the panicles are fairly dry the seed is beaten out and spread in a thin layer on canvas to dry further. Seed germinating 90 per cent or more has resulted from this method.

Preparation of the Seed for Market

The time when seed was so scarce that high prices could be obtained for uncleaned seed is about past. To prepare for market, all foreign material, bits of stems and chaff, should be removed and the lightweight seeds should be graded out. If farmers have reed canary grass seed to sell direct but do not have adequate machinery to clean well, arrangements may be made with a seed house to do the work on a custom basis. Fortunately in the Mankato district, except where a full stand of reed canary grass has not yet been established and reed meadow grass *(Panicularia grandis)* volunteers temporarily, there is seldom any other grass seed present and no weed seeds. This simplifies the cleaning process.

All purchases of seed should be made on sample accompanied by germination test from a state seed laboratory with the understanding that it tests as high as the sample.

Yields of from 35 to 390 pounds of seed per acre were harvested in Minnesota in 1929. One Oregon field of 7½ acres produced 3,000 pounds of cleaned and carefully graded seed weighing 35.2 pounds per measured bushel and germinating 90 per cent. The seed from this field was gathered by hand as it was impractical to gather by machine owing to the high percentage of lodging. The panicles were spread on the floor of a large building to dry.

IMPROVEMENT OF REED CANARY GRASS

Reed canary grass as grown commercially at present is a mixture of a large number of forms varying in height, maturity, leafiness, and other important characteristics. Some work has already been done on the selection of strains that are desirable from the hay and pasture standpoints and which retain their seeds better at maturity. Most

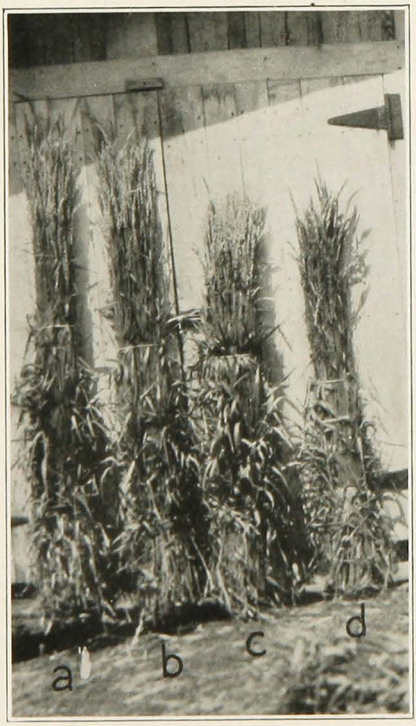


Fig. 13. Widely Different Strains of Reed Canary Grass

Bundle *a* is a tall growing, late maturing strain, lacking in leafiness, therefore undesirable. Bundle *b* is from a very desirable strain, leafy high up on the stems. Bundle *c* is an early, very leafy strain. Bundle *d* is an early strain lacking in leafiness.

strains are highly resistant to the rust *(Puccinia majanthae)* but one has proved very susceptible. In 1929 the rust was most in evidence on the second crop.

Indications are that some improvement in practically all characters of economic importance may be made.

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