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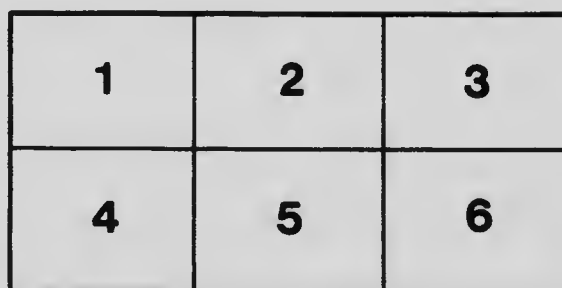
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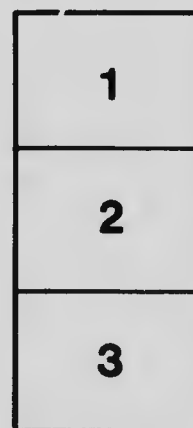
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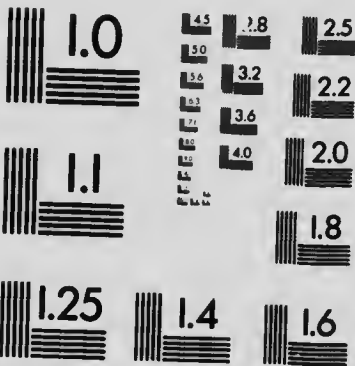
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MANITOBA AGRICULTURAL COLLEGE.

RUSTED WHEAT AND THE SEED SITUATION

For the Year 1917

By James H. Bridge, B.S.A., Cerealist,

Field Husbandry Department, Manitoba Agricultural College,
Winnipeg, Man.

Together with a Statement by the Manitoba Department of Agriculture as to
the Arrangements for Securing Seed for Farmers through the Activities
of the Seed Purchasing Commission.



The same number of seeds were sown in each of these pots, and the treatment was in every way exactly the same. The difference in growth arises entirely from the fact that the plants in the left hand pot grew from strong, plump seeds, and those in the other pot from very shrivelled seeds. Not only did the good seed produce more plants, but these began to grow quicker and were very much more vigorous.

SUMMARY

1. The problem of securing suitable seed supplies for the coming spring is serious and demands immediate attention.
2. Rusted wheat, grading as low as No. 5 Special, will usually show quite a satisfactory percentage of germination.
3. Notwithstanding the fact that it will grow, it is unreliable seed, because of the weakness of the plants and the tardiness of germination, which latter will delay ripening.
4. The danger of rust damage to next year's crop is not appreciably, or perhaps at all, increased by using seed from rusted plants.
5. On the contrary, the surest way to develop rust resistance is by using the seeds from those individual plants that, having been exposed to the rust infection, were able, largely, to resist it and develop well matured seeds.
6. Even though their crop was rusted, it would be unwise for farmers who possess superior strains of wheat to discard them entirely in favor of purchased seed. It being much more desirable that they use the fanning mill and grade out the heavier, plumper kernels from such grain and retain their present satisfactory strains of seed for at least a portion of their acreage.
7. On account of the weakness of sprouts from rusted seed, it should not be sown until danger from spring frosts is past.
8. The fanning mill should be used until the seeds retained are at least three-fourths of the normal size and weight.
9. Seed of small size or weight, if sown, should not be planted too deeply.
10. It is doubly advisable this year to have all wheat seed tested before sowing.
11. The Field Husbandry Department of the College conducts free seed tests.
12. Persons sending samples for testing should carefully follow the instructions given in this circular.
13. The Field Husbandry Department has organized a Seed Exchange Bureau for the purpose of bringing into touch with each other farmers who have good seed to sell and those wishing to purchase such seed.

Rusted Wheat and the Seed Situation for the Year 1917

The crop season of 1916 will go down in history as the great rust year. Not since the year 1904 has any such epidemic devastated the spring wheat area to anything like the extent that was the case this year, covering as it did much of our own Province, part of our sister province of Saskatchewan and the northern tier of States to the south of us.

So widespread and so thorough has been the destruction of the crop that the problem of securing suitable supplies of seed for the coming year is a serious one and demands immediate and careful attention. The nature of much of the correspondence that is now reaching the Field Husbandry Department of Manitoba Agricultural College, together with the large number of samples of rusted grain that are being received for germination tests, reveal an urgent need for the dissemination of information as to the best course to pursue in this unusual situation. It is to meet this need that this circular is presented.

Tests of Market Grades.

To gain first hand information as to the effect of the shrinkage due to rust on the germination of wheat, the Field Husbandry Department procured a large number of samples of the various grades from One Northern to Feed. These were placed under test and the results tabulated in such form that a comparison could easily be made of the relative standing of the various groups in respect to average germination, and the number of strong and weak plants in each case. From the results of these tests, it would appear that rusted wheat will show quite a satisfactory percentage germination, even in samples grading as low as Number 5 Special. It is quite noticeable, however, that the sprouts produced by the rusted grains are weaker than those from sound grain, the weakness exhibited being in proportion to the amount of damage done. Moreover, it has been proven by experiments that the plants from such seeds develop more slowly, thus delaying the time of ripening. In view of the importance of early maturity, particularly in rust seasons, one cannot emphasize too strongly the necessity for plump, well matured seed. The difference in respect to strength of sprouts is clearly shown in the figure on page 4.

It is not the purpose of this circular to enter into a lengthy discussion of the rust diseases. To those men with a rusted crop on hand it matters little whether the damage is the result of red

rust or black rust, leaf rust or stem rust. The main question is, how may we secure a supply of seed for the coming season?

Using Rusted Wheat for Seed.

So far as our present knowledge of the modes of rust infec-



The difference in strength of Sprouts from Plump, Well Matured Seeds and Rusted, Shrivelled Seeds of this year's production is shown herewith. The seeds above and below the black line were germinated on separate blotters under exactly the same conditions. Almost every grain in the lower rusted sample shows a small sprout, but germination in the upper lot of seeds was so much faster that the sprouts were an inch long by the time the shrivelled seed had commenced to grow. Such differences as these are characteristic

tion and propagation goes, it is, apparently, quite safe to use rusted wheat for seed in so far as danger of infecting the resulting crop is concerned. In this respect rust differs from smut. In the case of the latter, the resting stage or spore stage (corresponding to the seed stage in higher plants) may be passed upon the wheat grain itself, finding lodgement in the crease or on the hairs found at the tip of the grain. While it has been found that rust infection areas may be present in the grain, it has not been proven that rust may be propagated in this way. This may be partially accounted for by the fact that rust diseases, so far as is known, require an intermediate host plant to complete the life cycle, while smuts are able to complete their life history on the one plant. Moreover, smuts are not so particular in respect to their conditions of growth as are rusts. Hence we feel no hesitation in suggesting that, so far as the carrying of infection is concerned, seed from a rusted crop may be used with perfect safety.

Securing Rust-Resisting Strains.

So destructive was the rust to crops during the past summer that it seems to be quite unavoidable that some rusted grain must be used for seed. There may even be some advantages in using seed from a rusted crop as against introducing seed from an outside source. For example: Where a farmer has been carrying on seed selection work and has secured a high standard of purity, uniformity and yielding ability in a particular strain of wheat, it is highly desirable to use the grain for seeding, even though rusted. Severe fanning would remove the undesirable small grains and give a sample of seed that would be preferable to running the risk of introducing weed seeds or a poorer strain of wheat on the farm. Moreover, since the plant pathologist has as yet been unable to find any means of preventing the occurrence of rust, as can be done with smuts, it follows that some other means of combatting the disease must be adopted. One of the most natural means to this end would appear to be the development of rust resisting varieties or strains. Just how this is possible, however, is still an open question. If, however, there should be a possibility of securing rust resistance in any way, there could obviously be no better material found for making a beginning along this line than to use for seed grains from plants that have shown a measure of rust resistance during a rust attack, and have, therefore, produced a fair quality of grain. Regarding this point, Professor Bolley, of the North Dakota Agricultural Experiment Station, who has made a considerable study of this subject says: "All our tests show that the farmer may be able to procure very noticeable results by simply following the principle of selection by grading to form and weight." Rust

shrivels the seed of those mother plants which cannot resist it. Mother plants which are able to produce plump, well formed heavy seeds during one rusty season, have been found able to transmit this quality to the following crop, provided the crop is grown under similar conditions of soil and climate." It would thus appear that the present crisis in the seed situation affords our farmers an opportunity of making some advancement in the securing of rust-resistant strains of wheat.

Rusted Seed Low in Vitality.

The germination tests of rusted wheat prove that seed from a rusted crop, no matter how much shrivelled, if otherwise uninjured, germinates freely under good conditions, and it is likely that if the average weight of the grains in a sample of wheat is above one-half the normal weight of sound wheat, the ordinary rate of seeding would produce a stand. Although there would be an unusually large number of plants in the field, this would probably be offset by the fact that such seeds would produce thin, narrow-leaved plants with weak vitality and only slight stooling powers. (See Frontispiece). On account of this lessened vitality, rusted wheat should not be sown until the ground is thoroughly warmed up and the danger of frosts or cold spells is fairly well past. The photo on the front cover shows the nature of growth from rusted as against sound seed. Both were sown on the same day under similar conditions of soil, etc., and were photographed three weeks from planting.

Plump Seeds Give Best Results.

As to just how heavy per measured bushel rusted wheat should weigh in order to make fairly reliable seed, no fixed rule can be given, but it would seem unwise to use anything that is not at least three-fourths of the normal size and weight. Everything that does not come up to the required standard should be removed with the aid of the fanning mill. One must not be afraid to use a good strong blast, although it may mean working over a good deal of material. Experimental evidence proves that it does not pay to plant the light weight seeds. In the experiments conducted by Bolley during the season of 1904 and 1905, when rust was prevalent, heavy weight seed, graded from a rusted crop, excelled in yield heavy weight wheat of the same variety which had not been subjected to rust attack the previous season. Heavy weight seed graded from a badly rusted crop was said to show markedly greater resistance to rust than either the wheat from rust shrivelled seed or that which grew from plump seed of the same variety, imported from a non-rust region. Hence it would seem that the way to procure the best possible seed wheat is to grade out the shrivelled kernels each year that rust attacks the crop.

Weight per Measured Bushel Does Not Always Indicate Quality.

While discussing the question of the necessary weight of rusted grain, it should be pointed out that weight per bushel is not a sufficient indication of quality in this respect. Rusted wheat usually germinates quite well, and the reason why it is not wise to use it for seed in many cases is that there is but a relatively small amount of plant food for the use of the young plant just at the critical period of its growth, so that, should the plants meet with adverse weather conditions, such as the frost which cut down much of the wheat during the spring of 1915, it is quite likely that the areas sown with such light-weight wheat would fail to recover, necessitating re-seeding, with the consequent lateness of the crop. For this reason we believe that it is better to take into consideration the size or plumpness of the grain as well as the weight per measured bushel.

In order to compare the actual size and weight of different samples, we have adopted the plan of determining the weight per thousand grains. The following table, arranged from material grown on the College plots, with the exception of No. 1, which is wheat from a previous year's crop, presents some interesting comparisons.

Sample Number	Weight per Meas. Bus. (Lbs.)	Wt per 1000 kernels (Grains)	*Number of kernels per lb.	Approx. Grade
1	65.00	39.75	11,420	1 hard
2	58.25	26.35	17,230	2 Northern
3	56.00	18.265	24,850	3 Northern
4	52.50	20.04	22,650	No. 4 Wheat
5	47.25	14.41	31,500	No. 5 Wheat
6	40.25	11.565	39,250	Feed.
7	37.00	9.00	54,440	"

* The average number of kernels per pound is from 12,000 to 16,000.

These figures indicate quite plainly that there is no definite relation between weight per measured bushel and the number of grains in a bushel, which is really determined by the size of the grains. It is seen that sample number 3, which has a very fair weight per measured bushel, is made up of grains weighing actually less than half that of the plump grains found in number 1 sample. Sample number 2 is the best wheat from the "date of seeding" experiment conducted at the College the past summer. It is quite evident that it would not make good seed until a percentage of the poorer grains were cleaned out. The cut on page 2 shows in a more graphic manner the difference between num-

bers 1 and 3, there being an equal number of grains in each tube. In view of the facts here presented, we feel that in a year such as

this very little reliance can be placed on the factor of bushel weight when considering the question of seed grain. Rather, we should base our estimate of its value for seeding purposes on the size of the grain, consistent with soundness, and unless, as previously stated, the individual grains are at least three quarters of the normal size and weight, the securing of new stock must be considered.

Where seed that is somewhat below the standard size and weight must be used, it would be well not to plant too deeply. It should be borne in mind that the depth at which the root system of the wheat plant develops is not dependent upon the depth of planting. Deep planting of seed low in vitality may cause a loss in stand, should untoward weather conditions prevail, and will, at least, tend to retard the development of the plants, which in itself is a point to be carefully guarded against, particularly in years when rust is prevalent.

Seed Grain Should Be Tested.

At a time like this, when the crop has in many cases been subject to damage from bad weather conditions after harvest, in addition to that resulting from rust, it is doubly advisable to sow no grain that has not been sampled and tested for germination. The shrivelled

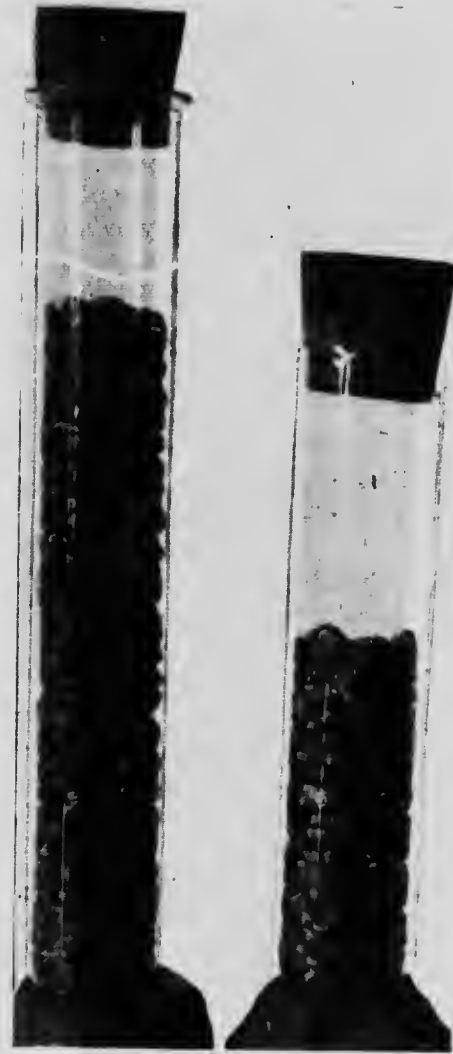


Fig. 3.—There are 500 grains in each of these tubes. The long tube holds seeds of Sample No. 1 in the table on page 7. The shorter tube contains grains of Sample No. 3. The point to note is that although one lot weighs 56 lbs. per bushel as compared with 65 lbs. per bushel in the other sample, its kernels are only about one-half the size. The amount of plant food in a seed is not, therefore, in proportion to the weight per measured bushel.

condition of rusted wheat is an indication that it did not mature properly. If such wheat has been exposed so that it is badly

weathered or has become heated, it should not be used for seed. It very easily becomes soft and loses its power of growth much sooner than plump, hard wheat. The same remarks will apply also in the case of grains other than wheat.

During the past six years the Field Husbandry Department of the College has conducted germination and purity tests for farmers. During that time thousands of samples of wheat, oats, barley, flax and grass seeds have been tested. This work is being continued this year, the Department being well equipped to handle a large number of samples. Farmers are invited to make use of this Department.

Sending Samples.

No charge is made for these tests. Care should be taken, however, that the mailing charges on samples sent in are fully prepaid. We wish to draw particular attention to this, for the reason that quite a number of samples reach us on which we find it necessary to pay excess postage in order that they may be released. This occasions delay and also considerable expense, since the excess postage is always charged at twice the ordinary rates.

Strong Manilla paper or cotton bags should be used for sending samples. Samples sent in slender card-board boxes, such as matchboxes, etc., are liable to become lost or the samples mixed together through breakage. They should be put up in such a way as to admit of inspection or they will be charged for at letter rates. Paper bags, such as are used by elevator firms, are particularly suitable for this purpose. If put up in this way, the rate of postage will be one cent per ounce. No war tax is necessary on parcels of this nature. Letters should be sent separately, or the ordinary letter rate will be charged for the whole parcel. All samples should be marked by the sender with:—

- (a) Name and address.
- (b) A distinguishing number, letter or mark, where more than one sample is enclosed.
- (c) The word or words "purity," or "Germination," according to the information desired. Letters of advice should not be enclosed with samples, unless they are sealed and paid for at letter rate.
- (d) Address all samples: "Seed Testing Laboratory," Field Husbandry Department, Manitoba Agricultural College, Winnipeg.

Size of Sample.

For purity tests the following amounts should be submitted:—

- Timothy and seeds of similar size, 1 ounce.
- Red Clover, Alfalfa, and seeds of similar size, 2 ounces.
- Wheat, Oats, Barley, etc., 1 pound.

For germination test only, smaller quantities will suffice, say, two to four ounces of the cereal grains and relatively smaller amounts of other seeds.

How to Take Samples for Test.

In securing samples for analysis or germination test, care should be taken to have them representative of the bulk lots from which they are drawn. If taken from a bin, some grain should be drawn from the lower portions as well as from near the surface of the grain, since that at the top may consist of the cleanings from around the threshing machine and be inferior in quality. Mix the portions from the various parts and take the final sample from this composite heap.

Interpretation of Results.

The information given in a purity test report includes:—

- (a) Kind of seed.
- (b) Laboratory test number.
- (c) Sender's designation.
- (d) Name and number of weed seeds per ounce.
- (e) Name and number of other kinds of grain per ounce.
- (f) Total number of weed seeds per ounce.

It is thought best to point out that the College has no authority for making official analysis as required by the Seed Control Act. Anyone desiring to have such official analysis and grading of Alfalfa, Clover and Grasses should forward them to the Seed Laboratory, Department of Agriculture, Calgary, Alberta.

The information given in a germination test report includes:—

- (a) Kind of seed.
- (b) Laboratory test number.
- (c) Sender's designation.
- (d) The preliminary test, or percentage of seeds that germinate during the first few days.
- (e) The final test, or total number of seeds that germinate.
- (f) The number of hard seeds.

The preliminary test is reported as strong seeds, since such are usually of high vital energy. Those germinating later are not so satisfactory for seed.

Under the heading of "Remarks", comments as to the condition or value of the seed for sowing are made where necessary, as well as such other information as may be deemed helpful.

Seed Exchange.

In order to assist in bringing together those who desire to secure seed grain and those who have good seed grain to dispose of, the Department of Field Husbandry has organized a Seed Exchange Bureau. Samples of good grain will be accepted from any farmer for this purpose. Germination and purity tests will be made and filed for reference, after reporting same to the sender

of the sample. Upon receipt of an enquiry for seed grain, the Department will place the enquirer in touch with farmers able to supply his needs.

Samples sent in for this purpose should consist of at least a pound of grain cleaned in such a manner as to be representative of the material that will be shipped out to purchasers, and the package should be marked "Seed Exchange". A sample of this size should be sent by parcel post. In a letter of advice the farmer should state the amount available for sale and the price of same. It is hoped that this branch of service will be used to a considerable extent this winter.

APPENDIX

Statement by Manitoba Department of Agriculture as to Government Arrangements for Aiding Manitoba Farmers in the Purchase of Seed Grain for Sowing in 1917.

SEED GRAIN PURCHASING COMMISSION

The Dominion Department of Agriculture has appointed a Special Commissioner for the three Prairie Provinces, with an assistant for each (Manitoba, Saskatchewan and Alberta), to secure, clean and sack, when ordered, seed wheat, oats and barley.

This seed will be cleaned at the Government elevators in Calgary, Saskatoon, and Moose Jaw, under the supervision of the inspectors of the Seed Branch, and will be in compliance with the Dominion Seed Control Act.

The seed will be available to municipalities, grain growers and farmers in municipalities where hail, rust and frost have damaged the grain, and will be sold for cash.

The Commission will purchase grain for seed purposes subject to official grading and weighing at the Government elevators, and will pay not more than five cents per bushel for No. 1 and three cents per bushel for No. 2 seed wheat in advance of the closing price for the day on the Winnipeg Grain Exchange. From the purchase price (which is on the basis of delivery at Fort William) freight charges will be deducted.

The price that may be charged for seed grain will be sufficient only to cover the cost of the grain at the time of purchase, which as nearly as possible

Nomenclature of grades of grain for seed purposes distributed by this Commission shall be as follows:—

No. 1 Canada Western seed Oats shall be composed of No. 1 or No. 2 C.W. oats, shall contain 95% of white oats, sound, clean, and free from other grain; shall be free from noxious weed seeds within the meaning of the Seed Control Act, and shall weigh not less than 34 pounds to the bushel.

No. 3 Canada Western seed Barley shall be composed of the six-rowed variety, sound, plump and free from other grain, of fair colour, free from noxious weed seeds within the meaning of the Seed Control Act, and shall weigh not less than 45 pounds to the bushel.

WHEAT: Class 1.—No. 1 Manitoba Northern seed Wheat shall be composed of at least 85% of Red Fife or 85% Marquis wheat, sound, clean and free from other grain, and free from noxious weed seeds within the meaning of the Seed Control Act, weighing not less than 60 pounds to the bushel.

WHEAT: Class 2.—No. 2 seed Wheat shall be composed of grades No. 2 Northern, No. 3 Northern, or No. 4 slightly frosted wheat, of Red Fife or Marquis variety, and when re-cleaned shall be practically free from other grain and noxious weed seeds, and the weight not less than 58 pounds to the bushel.

For Class 1 and Class 2 seed purposes, Red Fife and Marquis wheat shall be kept separate.

(Within the meaning of the Seed Control Act means: Not more than one noxious weed seed per pound of grain.)

will be market price at time order is received for shipment, plus equitable cost for freight and actual cost for cleaning, sacks, sacking, loading ex-elevator, and other incidental expenses. In purchasing and inspecting this seed both the services of this Commission and the Dominion Seed Branch staff will be available free of charge.

Approximate charges above mentioned for No. 1 seed are:—Stop-over, 3-5c; premium (because of superiority over ordinary commercial grain), 5c; elevator charges, $\frac{1}{2}$ c; cleaning, $1\frac{1}{2}$ c; shrinkage in grain in cleaning, 8c; collection and incidental expenses, 2-5c. Total charges, 16c.

If sacks and sacking are required, add 15c per sack and 1c per bushel for sacking, which will make an additional charge of $8\frac{1}{2}$ c per bushel.

The freight charges between Moose Jaw and Fort William amount to 10 4-5c per bushel, which just about covers the stop-over, elevator charges and shrinkage, making the price of the grain approximately Fort William price with premium of 5c added for No. 1 seed and 3c for No. 2 seed, with spread in grades deducted from price.

When this seed is shipped from the elevator to the purchaser, a drawback of 2-5ths of the cost of the inward freight is allowed by the railway, which is applied on the outward freight, which allows the seed (if in carload lots) to go to purchaser either free or at a very small cost, so far as outward freight is concerned.

This Commission requests the prompt assistance of the municipal governing bodies in helping to procure these seed supplies, and specially draws the attention of municipalities and farmers' organizations to the necessity of placing their orders for seed grain at an early date. The Commission will purchase grain for seed purposes only to fill orders received by them.

All correspondence, including orders for seed grain, should be given, or addressed, to—

MR. A. E. WILSON,

Commissioner and Chief Agent,

Seed Grain Commission,

Post Office Building,

Regina, Sask.

HOW THE FARMER MAY OBTAIN THIS SEED

The Commission mentioned is now accepting orders for seed grain. It is obvious that freight charges will be much less if the orders are for carload lots, and carload orders are encouraged and generally expected.

The Manitoba Department of Agriculture is at present trying to ascertain through the municipalities of the Province the amount of seed required by farmers in each part of Manitoba. It is intended to have discussed at the next session of the Manitoba Legislature the extension to municipalities of power to act as agents in purchasing seed grain and re-selling it to farmers on credit. The municipalities have not at present the right to extend such aid to farmers, though it is understood that in some municipalities the members of councils have been active in promoting collective buying by individual farmers who pay the cash. The action of the Legislature cannot be forecasted. It may be pointed out also that even though such legislation were passed, many municipalities might still remain inactive. Individual farmers in these municipalities who need seed wheat would still, therefore, require to purchase it at their own expense.

For these reasons, all farmers and farmers' organizations who require to purchase seed grain, and are able to finance the project without municipal aid, are urged to act on their own initiative.

