Oat Culture in Michigan
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OAT CULTURE

in Michigan

EXTENSION DIVISION, MICHIGAN STATE COLLEGE

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EAST LANSING

SUGGESTIONS FOR IMPROVING MICHIGAN'S OAT CROP

1. Include oats in a rotation properly balanced with legumes.
2. Save plowing expense by growing oats after such cultivated crops as corn, beans, potatoes and sugar beets, in which case discing may properly be substituted for plowing.
3. Provide proper plant food. (Detailed fertilizer recommendations for specific soil types are given in the current Michigan Extension Bulletin 159.)
4. Choose adapted varieties. Wolverine and Worthy are excellent mid-season varieties for the Lower Peninsula; Iowa 444 is a rust resistant variety recommended for the Upper Peninsula; Gopher, Iowar and Minrus have advantages on muck. Consult your county agricultural agent or the Michigan Agricultural Experiment Station, East Lansing, for the latest information on promising new varieties.
5. Plant clean seed of strong germination.
6. Drill 2 bushels per acre on a clean, firm seedbed.
7. Plant as early in the spring as weather conditions permit.

OAT CULTURE IN MICHIGAN

E. E. Down and J. W. Thayer, Jr.

Oats have been one of Michigan's chief cereal crops since pioneer days and at the present time, rank second only to corn in acreage. Their value as a stock feed, their favorable response to Michigan's climatic conditions, and their convenient use in rounding out crop rotations caused oat acreage to increase rapidly with the agricultural development of the state. Michigan's oat acreage passed the million mark in 1902. Further increases took place until 1925, when, according to revised Federal[1] estimates, 1,617,000 acres were harvested. By 1929, the acreage had dropped to 1,225,000 and has remained near that amount since. The reduction in acreage was uniform over the state except in the Upper Peninsula, where the 1935 acreage of 58,600 was only 61.4 per cent of the 1925 high.

Climatic conditions in Michigan are favorable to oat production. An average Michigan season provides sufficient rainfall for vigorous growth and temperatures cool enough for the growing of high-yielding, mid-season, spring varieties with grain of good quality. Both yield and quality are favored by planting oats before April 25.

The 1934 distribution of oat acreage by counties is shown in Fig. 1. A comparatively small acreage is grown north of the Muskegon-Isabella-Bay County line, largely because of the greater development of agriculture and a more favorable soil south of this line. The leading oat counties are in the eastern two-thirds of the southern half of the Lower Peninsula. The largest acreage is grown and the highest yields per acre are obtained in the Thumb district.

Government records reveal that the yearly average yields of oats for Michigan have varied from 18.5 to 40.00 bushels per acre during the past 50 years. Due to unfavorable weather conditions, the average yield per acre of oats for the past five years is decidedly below the 50-year average of 31.4 bushels. Comparison of yields obtained by the more successful growers with state average yields clearly shows that the yield of oats can be improved by the use of modern cultured practices, the proper seed treatment for disease control, and more productive varieties.

SOIL FOR OATS

Oats do best on fertile well-drained loams and clay loam having sufficient organic matter to provide good water holding capacity. This is necessary to carry the crop through any dry periods that may occur during the heading and filling periods. Light soils are inclined to be

[1]V. H. Church, Agricultural Statistician for Michigan.

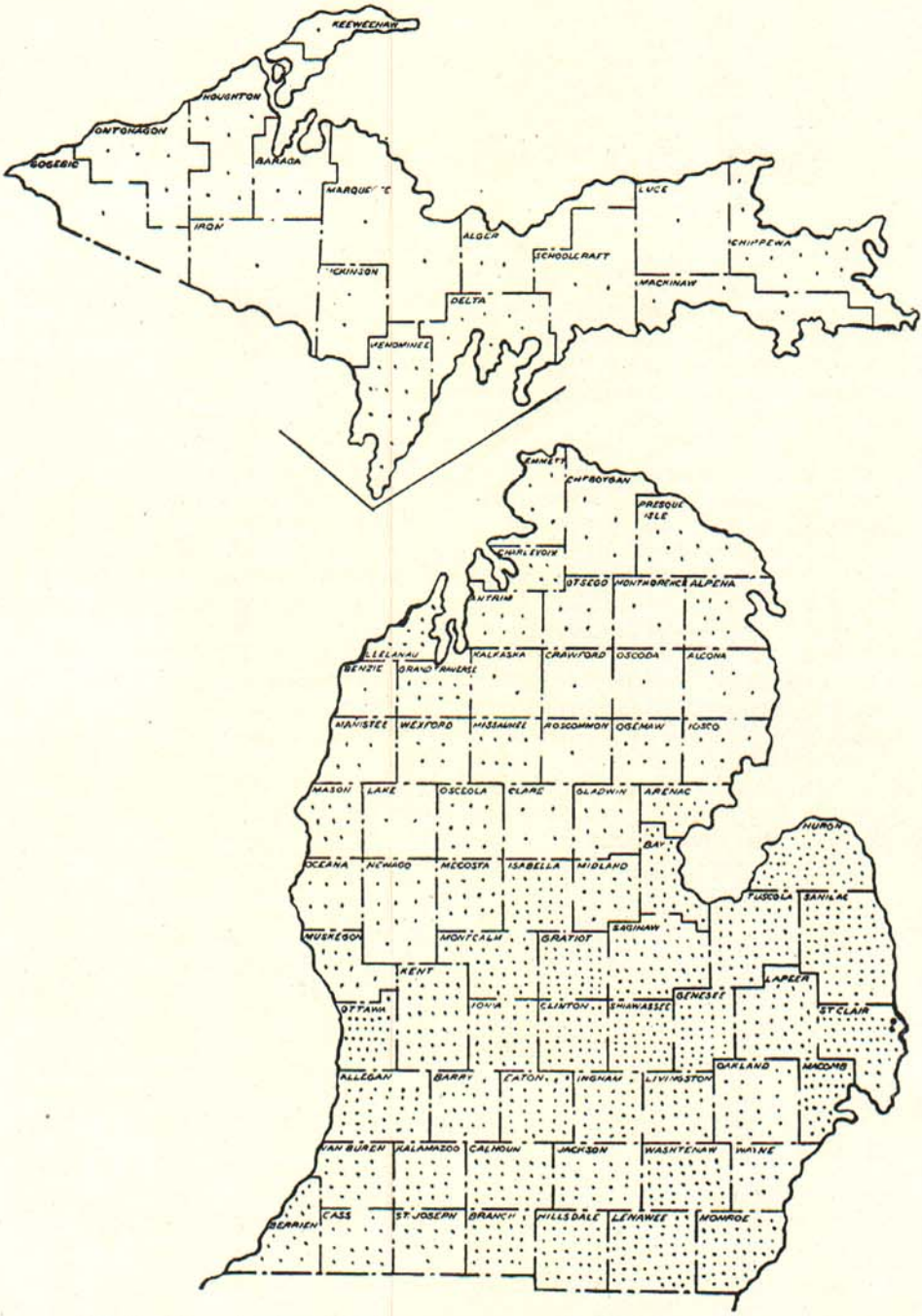

Fig. 1. Map showing Michigan oat acreage in 1934 (census figures). Each dot represents 1,000 acres.

too drouthy for the production of thrifty growth and high yields. Comparatively good results may be obtained by growing oats on muck soils, if the proper variety is used. The varieties recommended for upland soils are both too late and too weak of straw for use on muck.

COST OF GROWING OATS

The cost of growing a crop of oats, including all field operations, interest on land and taxes, is approximately $17 an acre.[2] This is entirely too high to permit a reasonable net return unless better than average yields can be obtained. The average Michigan oat yield for the last 10 years was 29.1 bushels per acre, and the average farm price was 40 cents per bushel.

Even at best, oats cannot be considered a high income crop. The reasons for growing the crop include its use as a source of home-grown stock feed, the value of the straw as coarse roughage and bedding, and the convenience of oats as a nurse crop for grass and legume seedings. Only 7 per cent of the Michigan oat crop has been sold for cash during the last 5 years. That yields vastly greater than state average are possible is shown by the fact that certified seed growers of the Michigan Crop Improvement Association in 1936 produced an average yield of 56 bushels per acre, which is approximately the long-time average for this group. The production of 80 bushels per acre is common. Winners of the Ira H. Butterfield 5-acre oat contest of the Michigan State Fair have averaged 95.9 bushels per acre since 1928, and the record yield obtained in this contest was 125 bushels per acre by George Aldrich and Sons of Fairgrove in 1930.

FERTILIZERS

Barnyard manure may be used to best advantage on the crops preceding oats in the rotation such as sugar beets, beans, potatoes or corn. If manure is applied directly for oats, the nitrogen of the soil is likely to become too high. Large amounts of available nitrogen in the soil will tend to produce a rank growth of weak straw that will lodge badly. Also, such rank straw growth increases the atmospheric moisture near the soil and this condition favors the development of mildew which further weakens the straw. When barnyard manures are used with the preceding crop, the residual effect is beneficial to the general growth of the oats and to grain development.

Members of the Michigan Agricultural Experiment Station Soils Section point out in "Fertilizer Recommendations for 1936,"[3] that an efficient use of commercial fertilizers can be obtained by fertilizing heavily the more valuable cash crops of a rotation and supplementing the fertilizer remaining in the soils with smaller applications for less valuable crops. They suggest an application of 150-250 pounds of acid phosphate, or a complete fertilizer high in phosphate for oats on upland soils. For muck soils, 250-400 pounds of 0-8-24 fertilizer is quite generally recommended.

[2]Michigan State College special bulletin 241.
[3]Michigan extension bulletin 159.

The use of acid phosphate for oats is almost universally beneficial on Michigan upland soils as it tends to balance the straw growth and grain development and aids in maturing the crop more uniformly. This is especially true of heavy soils where the nitrogen content needs balancing, and potash may be made more available by the presence of certain forms of phosphates.

The possibility of obtaining profitable yields of field crops is greater from soils carrying sufficient lime for average legume growth than from those strongly acid. The benefit of lime to oats is mainly indirect on many Michigan soils, as the presence of lime is necessary for the growing of the soil-building legumes such as clover or alfalfa. Where the successful growing of clover or alfalfa has become difficult, the application of two tons of ground limestone, six to eight loads of marl, or 1,000 to 1,500 pounds hydrated lime per acre preceding seeding will probably regain the lost ability of such soils to grow these legumes and materially increase the production of cultivated crops. Limestone, marl, or other forms of lime should be applied in the rotation when fitting the seedbed of a cultivated crop or prior to the seeding time of oats.

Specific recommendations pertaining to the use of commercial fertilizers on all types of Michigan soils for oats are given in "Fertilizer Recommendations"[3] of the Soils Section. Your county agent has this information for distribution.

ROTATION

The oat crop fits well into Michigan's diversified agriculture. It readily follows sugar beets, beans, potatoes or corn. Fields of those crops which are cleanly cultivated and are harvested too late in the fall to allow safe planting of wheat, leave the soil in excellent condition for the oat crop.

Where the vegetative growth is not too great, oats are successfully used as a nurse crop for clover, alfalfa, and grasses. The water requirement of oats is so great that this crop cannot ordinarily be used as a nurse crop on drouthy soils. The latter condition may be overcome, in part, by seeding the oats at less than normal rate, by sowing a much earlier variety than is normally grown, or by cutting the oats early for hay.

Many farmers find that better results are obtained from oats after sugar beets than after beans. Oats after beets do not produce as rank a growth of straw, and are less liable to lodge. For this reason, oats are more suitable as a nurse crop when planted after beets.

VARIETIES

Experiments have shown that, due to different climatic conditions, the same varieties of oats are not adapted to both the Lower and Upper Peninsulas. Mid-season oat varieties normally do much better than early varieties in the Lower Peninsula. Mid-season varieties

[3]Michigan extension bulletin 159.

give poor returns in the Upper Peninsula because of their susceptibility to stem rust which often severely attacks susceptible varieties in that section.

A list of mid-season varieties that yield well on upland soils in the Lower Peninsula includes Wolverine, Worthy, Victory, Crown, Golden Rain, and possibly the new Star. The Wolverine is the most extensively grown. It is adapted to a wide range of soils, doing best on the medium-heavy soils where lodging is not a factor. The Worthy has the same grain type as Wolverine, but heads and ripens from one to three days later. It is shorter and stiffer of straw and is adapted to those heavy soils where lodging is troublesome. The remaining varieties mentioned possess no advantages over Wolverine. They are as late as Worthy and have the stiffness of straw of Wolverine.

Fig. 2. Markton and Wolverine growing on medium heavy soils. Markton (right) is lodged. Wolverine (left) standing upright. In Michigan, Markton can be used on lighter soils.

Comparative yield per acre, earliness of heading and weight per bushel of five oat varieties grown at the East Lansing station are given in Table 1. Wolverine and Victory were equally productive. Worthy and Iogold were slightly less productive, but they did not have the proper conditions to bring out their superiority. Wolverine heads 2-3 days earlier than Worthy or Victory. Iogold is an exceptionally early oat, heading some 4-8 days before Wolverine. Wolverine was superior in test weight to the other four varieties each year.

The Markton, a smut-resistant gray-kerneled variety, is adapted to the lighter soil types. It usually heads and ripens a few days earlier than Wolverine. Because of its weak straw, it should not be planted on medium-heavy or heavy soils.

Table 1. Comparative results obtained with four oat varieties at the East Lansing station in 1933, 1934, and 1936.

Variety	1933	1934	1936	Average
	Yield in bushels per acre			
Wolverine	63.9	31.8	76.0	57.2
Worthy	59.0	28.5	72.2	53.2
Victory	62.4	31.4	75.1	56.3
Iogold	65.7	26.8	67.5	53.3
Markton	57.1	30.1	72.0	53.1
	Date of heading			
Wolverine	6/30	6/22	6/20	6/24
Worthy	7/2	6/25	6/21	6/26
Victory	7/1	6/26	6/23	6/27
Iogold	6/22	6/18	6/13	6/18
Markton	6/27	6/19	6/20	6/22
	Weight of grain per bushel			
Wolverine	32.0	27.6	34.0	31.2
Worthy	31.6	24.5	31.5	29.2
Victory	31.5	26.5	31.6	29.9
Iogold	30.4	24.6	31.5	28.8
Markton	30.3	25.9	33.6	29.9

In those sections of the state where stem rust is prevalent, the Iogold or Iowa 444, two early varieties, will give satisfactory yields on upland soils. The value of those oats in the Lower Peninsula is

Fig. 3. This picture contrasts the difference in height of Wolverine (left) and Iogold (right), growing on medium heavy soil. Iogold is over-ripe as indicated by crinkling straw.

limited as the severity of stem rust infections is seldom sufficient to prevent the Wolverine variety from giving better returns per acre. Two years in three, as shown in Table 1, Wolverine out-yielded Iogold. Wolverine has a higher test weight than either Iogold or Iowa 444.

Dr. Paul Harmer, of the Soils Section, recommends Gopher, Iowar, and Minrus for muck soils. Gopher and Iowar give similar results. Minrus is superior in dry seasons and lodges more during wet seasons than Gopher or Iowar.

Fig. 4. Markton (left) and Wolverine (right) growing on light soils. The Markton variety will stand up on this type of soil and will give about the same yield as Wolverine.

SEED PREPARATION

The use of a good fanning mill insures the planting of well-filled plump seed, free from dirt and weed seeds. The cost involved is of minor importance in comparison with the benefit derived from the removal of weed seeds and light oats. If the seed contains inseparable weed seeds, a clean supply of oats should be obtained. The seed should be treated to control certain of the major oat seed-borne diseases, unless resistant varieties are used.

OAT DISEASES

The major oat diseases that occur in Michigan, are loose smut, covered smut, and stem rust. Occasionally oat scab, crown rust, and powdery mildew are severe.

Despite the fact that oat smuts are easily controlled, they continue to take an enormous annual toll. While the Michigan Crop Improvement Association requires that fields, to be eligible for inspection, must be planted with treated seed, even so, a year never passes without some oat field failing to pass inspection because of the presence of smut. This is always due to conditions that are within the control of the grower.

Two forms of smut are common in oats, and they are known as loose and covered smut. The two forms, however, are not easily differentiated except by those familiar with the diseases. Infected heads of both diseases appear approximately as the heads are emerging from the boot. The spores are dispersed by the wind or by the harvest operations to surrounding healthy seeds. Fortunately, for the grower, both forms are controlled by the same treatments.

Stem rust of oats is prevalent throughout Michigan, and may cause severe losses. Conditions are more favorable for severe attacks in the Upper Peninsula. Stem rust is most apparent to the grower between heading and ripening of the oat plant when reddish brown pustules appear under the epidermis of the stems and leaves. Before harvest, these pustules rupture and liberate large quantities of red spores which are easily recognized and from which the disease gets the name of "rust".

Crown rust seldom causes severe loss in the Michigan oat crop. The infection appears mostly on the leaves, but it may also appear on the stems.

Scab of oats is not easily recognized because the loose hull of the oat prevents the distinctive characteristics of the disease from showing. With mild attacks, the infected kernels are slightly browned at the base, whereas, with heavy infection, a typical pink fungous growth appears.

Powdery mildew of oats is seldom serious in Michigan, although, occasionally, severe attacks occur. This disease is easily recognized by the white mildew growth that appears on the upper side of the leaves. In severe cases, the leaves are completely killed, thereby decreasing the yield and causing a poor grade of light, shriveled grain.

CONTROL MEASURES

SMUTS

Dr. J. H. Muncie[4] states that the treatments recommended to control oat smut also control or reduce the effect of seedling diseases. Mildew, a non-seed-borne disease has no practical control in Michigan, at present.

[4]Michigan State College circular bulletin 142.

Resistant varieties are the best means of consistently controlling these diseases. Unfortunately, the varieties generally recommended for Michigan, such as Wolverine and Worthy in the Lower Peninsula and Iogold and Iowa 444 in the Upper Peninsula are not resistant to the oat smut fungus. The development of a smut-resistant, relatively early oat with a stiff straw is one of the aims of the present breeding program of members of the Farm Crops Section. Several strains have already passed through the preliminary tests, and three of the better ones are included in over-state trials.

Concentrated Formaldehyde Treatment—A solution consisting of 1 pint of formaldehyde to 4 or 5 pints of water is sufficient for treating 50 bushels of oats. Use proportionate amounts of solution for proportionate amounts of grain. The solution is placed in a hand sprayer and sprayed on the grain as it is shoveled over and over. Irritation to the nose and throat of the workers from the formaldehyde fumes is lessened by treating the grain in a strong draft or in a well-ventilated room. Shovel treated grain into a pile and cover with clean sacks or blankets for **exactly four hours** and then spread thinly to dry. Stir several times while grain is drying. If planting is delayed, grain can be sacked after it is **thoroughly dried.** Sacking before grain is thoroughly dry will allow fumes to continue their action and reduce germination. All grain sacks should be treated to destroy smut spores.

Sprinkling Method—This method is similar to the concentrated treatment. One pint of formaldehyde is diluted with 10 gallons of water and sprinkled on the grain, allowing 2 quarts of solution to 1 bushel of well-fanned grain. Treatment is best accomplished by spreading grain thinly on a well-cleaned area and shoveling sprinkled grain over and over until it is all moist. After all grain is treated, shovel it into a pile and cover with clean sacks or canvas for 2 to 8 hours, spread thinly and allow to dry. Grain must not be allowed to freeze or remain too long without stirring. If planting is delayed, treated grain can be sacked if it is **thoroughly dried.** Grain sacks should be treated to destroy smut spores.

Dust Treatments—Dust treatments containing some form of formaldehyde or organic mercury may be used in place of formaldehyde solution with equal success to control the oat smuts. The general use of these dusts has been retarded because of their greater cost. Recent improvements in the formula have reduced the cost per bushel to a point where they compare more favorably with the cost of formaldehyde solution. Ceresan is a trade name given to one of these dust products that give excellent results. Some growers are afraid of dust treatments because of their experience with copper carbonate for treating wheat, which "freezes" a drill when used in damp weather. This condition does not occur with the treatments mentioned.

Application of Dusts—Seed treated with organic mercury dust cannot be used for feed as the mercury compounds are poisonous. Precaution should be taken not to breathe an excessive amount of dust as it irritates the membranes of the nose and throat.

Apply the amount **recommended on the label** of Improved Ceresan for each bushel of grain. Rotate the grain in an air-tight container

until each kernel is covered with the dust. Mere shoveling over will not do. A mixer built on the plan of a barrel-churn is satisfactory. Plans for a satisfactory home mixer are available in Extension Bulletin 176, "Oat Smut Control" from Michigan State College Bulletin Office. Grain should be treated 5-8 hours before planting in order to allow the chemical sufficient time to kill the smut organisms. Seed treated in this way and allowed to stand several days before planting will deteriorate in germination. If planting is to be delayed for more than 5 days and less than 60, apply ¼ oz. of Improved Ceresan per bushel and after thorough mixing, store grain in coarsely woven untied bags. The latter recommendations are based on the results of recent investigations reported from the University of Illinois, by B. Koehler.[5]

STEM RUST

The stem rust of oats can only be controlled by use of resistant varieties. B. R. Churchill[6] recommended Iogold, a yellow variety, for the Upper Peninsula because of its resistance to stem rust. Recent results indicate that Iowa 444 should replace Iogold in that section. It is a white oat and consistently has a 6- to 8-inch taller straw than Iogold with the same degree of stem rust resistance. The general range of adaptability in Michigan of these two varieties has already been considered under the discussion of varieties. The development of mid-season stem rust resistant varieties is a part of the present breeding program of the Farm Crops Section.

CROWN RUST

This form of rust normally causes little damage in Michigan. The varieties of oats recommended for Michigan, are not resistant to the disease.

The complete recommendations of the Botany Department[4] of Michigan State College for the control of plant disease can be obtained from the local county agent or from the College Bulletin Office.

PLANTING OATS

Seeding of oats should be done as early in the spring as possible. Oats seeded after the first of May, normally yield less than those seeded in late April and much less than those seeded in early April. Early April-seeded oats take advantage of the cool growing period to produce a maximum growth. They normally escape hot dry periods at heading and filling time. In the Lower Peninsula early seedings of the same variety of oats are more likely to escape infection of stem rust than late seedings. Early-seeded oats produce more straw growth. They need phosphate fertilizers to hasten their maturity and to reduce the possibility of lodging.

Early-seeded oats can be planted at a lower rate than those seeded late. The average rate of seeding is 2 bushels per acre.

[5]University of Illinois bulletin 420.
[6]Michigan State College special bulletin 213.
[4]Michigan State College circular bulletin 142.

Oats seeded by drill or broadcast give approximately the same results if sufficient surface moisture is present to germinate those broadcast. Broadcast oats are often sown without preliminary soil preparation and dragged in. This is sometimes necessary because of unfavorable weather conditions.

GERMINATION TEST

The fact that oats appear bright is not a definite guarantee that they have a high germination. Oats may have a reduced germination because of poor shock, stack, barn, or bin storage conditions. The percentage of germination is so easily determined that a sample should

Fig. 5. Land which has grown clean-cultivated crops such as corn, beans, or sugar beets may quickly be brought into excellent condition for oats.

always be germinated before planting. In a covered pan, place 100 kernels between two wet blotters or cloth and set aside where the temperature is favorable for sprouting. After a few days, the percentage germinated can be read. Allowance in rate of seeding should be made for low germination or preferably, new seed with high germination should be used.

HARVEST

Oats are commonly cut with a binder and cured in long narrow shocks. Better grain color is obtained by cutting just as the grain has completely ripened. At that time, the least amount of green or discolored seed is present. Maximum yields and weight per bushel are obtained when the oats are fully ripe, but to avoid danger of lodging and crinkling of straw, binder harvest should start when the grain is in the tough dough stage.

The acreage of oats harvested by the small combines is increasing rapidly in Michigan. It is estimated that 300 new combines were purchased in Michigan in 1936. The rate per acre charged for combining compares favorably with the cost of binder harvest. Combining the grain also relieves the grower from the tedious time-consuming practice of "exchange" threshing. Oats do not shatter badly for 10-14 days after ripening, but they may lodge and increase the difficulty of harvest. A common practice is to windrow the crop at regular binder harvest time and combine the grain when dry. In most cases, grain can be combined sooner after a heavy rain than shocked fields of the same grain can be threshed. Unless straw is needed for other use, this is an excellent method of completing the entire harvest, in one operation, and disposing of the straw. However, oat straw is a valuable source of bedding or roughage feed and should be saved for such purposes.

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