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Mississippi Agricultural Experiment Station
Agricultural College, Mississippi

BULLETIN No. 147.

APPLE GROWING IN MISSISSIPPI

By H. C. THOMPSON.

FIG. 1. Twelve year old Black Ben Davis Apple Tree in full blossom, Starkville, Miss. Tree good shape, but branches a little too thick.

AGRICULTURAL COLLEGE, MISSISSIPPI.
APRIL, 1911.

Tucker Printing House, Jackson, Miss.
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APPLE GROWING IN MISSISSIPPI.

Introduction.

The apple is the most popular fruit grown. It is adapted to a very wide range of conditions, being grown in every state in the Union. It may be kept in the fresh state the whole year, ships well, and is used in more different ways than any other fruit. Like all other plants the apple tree responds to good care and attention. For best development, a cool climate is essential, but some varieties produce good crops of fruit in the warm parts of this country.

The demand for first class apples was never greater than at present and this demand is increasing. It now greatly exceeds the supply. Within the last fifteen years the production of apples has greatly decreased. In 1896 there were produced in the United States about 69,000,000 barrels, while in 1908, about 23,000,000 and probably less in 1909 than in 1908. Why this great falling off in production? The answer to this question is very evident to those who know the history of the apple industry in the East. Not long ago nearly every farm had its orchard and some of them were quite large. These old farm orchards supplied most of the market demand, for large commercial orchards were practically unknown. The rapid spread of destructive insects and diseases of fruits, within recent years, has forced the general farmer to abandon this type of orchard.

The future of the apple industry.—The market apples of the future will be produced by specialists, men who will devote their time and thoughts to the study of the problem. This change may be looked upon as a step in advance for specialization is an evidence of evolution and advancement. More and better fruit at a lower price will be the result.

Within the past decade more fruit trees have been planted than ever before and within a short time we may expect a great increase in the supply of apples.

Why apples should be grown in Mississippi.—Apple growing may never be of great commercial importance in Mississippi, but the writer
sees no reason why it should not be of much more importance than it now is. It has been demonstrated that good apples can be grown in the state and at a profit. Even if they could not be grown commercially there is no reason why the farmer cannot grow enough for home use. It is often said that apples can be bought cheaper than they can be grown in the South. Granting this to be true, can the farmer and others who would buy them get apples and good ones when they want them? Very few first-class apples reach the smaller towns in Mississippi. The bulk of the apples found on our local markets are No. 2's or culls. These have sold at times for two dollars and more per bushel by retail and found the demand at these prices greater than the supply. Can we not grow apples of better quality here at less cost? The writer thinks we can. Diversification is the keynote to success on the farm. Fruit should be regarded not as a luxury but as a necessary article of food. The sooner more of our farmers cultivate the habit of growing a greater variety of food crops at home the sooner we will be on the road to prosperity. The less we buy and the more of the surplus we sell the greater will be our progress.

**Location and site.**—For a commercial orchard it is important to be near a market if a home market is to be supplied, or near a good transportation line if a distant market is to be supplied. It is not essential to be near a market, for many of the large apple orchards are hundreds of miles from the markets they supply. It is important, however, to be near a good road and near a railroad, for hauling over a bad road bruises the fruit and thus injures its appearance and keeping qualities. Cost of hauling is considerable if the shipping point is many miles from the orchard. For a home orchard we select a location near the home because convenience is one of the many points to be considered.

The best site for an orchard is gently rolling land with a north or northeast slope. Always avoid flat land or valleys for cold air, being heavier than warm air, settles to the lower places and frost is more likely to kill the blossoms in such locations. If planted on the south side of a hill the trees will be warmed by the sun in spring, and, being protected from the cold north winds, will blossom early and may be killed by frosts. On the north slope the cold winds will keep them in a dormant condition longer or until danger of frost is past. Much of the land that is too hilly for profitable production of other crops will produce good crops of apples if given the proper care and attention. In
some sections apple growing is a profitable industry in the mountain regions, as in North Carolina. On such land terracing is important.

Soils for apples.—Apples will grow on a great variety of soils, but most kinds do best on deep, rich clays or loams. Soils very rich in nitrogen should be avoided as they will produce too much wood growth at the expense of fruit. Very few soils in Mississippi are too rich for apples, however. Many farmers plant their fruit trees on the poorest and roughest piece of land on the farm, because such soil will not produce any other crop profitably. If the trees do not produce good fruit in a few years, without any attention, the orchard is abandoned and the farmer says fruit growing is a failure. Does he expect this of other crops and has he a right to expect it of apples? Give apple trees the care and attention that other crops get and they will respond by producing profitable crops of fruit. It is a mistake to expect trees to grow well on poor soil for food is just as essential to tree growth as to the growth of cotton or corn. It requires a large quantity of food to produce a crop of trees and even a greater quantity to produce the fruit.

Varieties to plant.—The question of what varieties to plant is one of the hardest to answer, for some varieties are adapted to certain conditions while other varieties are not at all suited to those conditions. Whether selecting for a home or commercial orchard, would determine what varieties to plant. For commercial purposes we would select a few standard varieties of vigorous growing trees which bear well, and produce fruit of a good color and size that ripens evenly, stands storage, and ships well. These characteristics are sometimes found in varieties like the Ben Davis and Gano, which are very poor in quality. For home orchards we would choose a larger number of varieties with special reference to the quality, and without considering shipping properties or appearance.

There is only a limited number of varieties of apples adapted to the South and only a few of these have been tried in Mississippi. Among the varieties that are adapted to growing in this state are the following: Red June, Early Harvest, Red Astrachan, Yellow Transparent, Champion, Commerce, Black Ben Davis, Day, Yates, Horse, Roxbury Russett. The first four are early summer varieties while the others are either late summer or fall and winter varieties. There has been so little work done on the apple in this state that very little is known about its adaptability.
Laying out the orchard.—The soil should be well drained and thoroughly prepared, as for any other crop, before laying off the land for trees. A very common method used now is to mark off the rows and use a two horse breaking plow to open up the furrows. By running four times in the row, throwing the furrows both ways, very little extra digging will be necessary in setting the tree. Another method followed is to mark off the land by use of a string and set a stake where each hole is to be dug. Get a good strong line the length needed and stretch it to get out the elasticity, then tie a piece of red yarn tightly about the line at the exact distance the trees are to be planted apart. On a quiet day stretch this line tightly along one side of the field and set stakes at each mark, then stretch it across another side at right angles to the first and set stakes at each mark as before. Next mark the third exactly parallel to the second and then by placing the line between corresponding stakes on opposite sides of the field and setting stakes at each mark, straight rows will be insured. On land not level enough for this the stakes may be sighted in. This latter method was used by the writer in planting out an orchard on hilly, rough land and in consequence the rows are straight in each direction. The land was in sod and was not plowed at all. The sod mulch method, to be explained later, is being used.

On hilly land to be cultivated rows are usually run around the hill so as to prevent severe washing. The method of laying out such land is as follows: "If the slope is fairly regular—that is, with no 'draws' or 'coves'—one can measure up and down the hill and locate the end of the rows on a base line at each end of the piece. If the land is not very steep, one can start at a bottom corner and measure up the hill, laying off the rows according to the distance desired between the trees. If the trees are to be 35 feet apart, which is the least distance standard trees should be set, he will simply measure up the hill, using one of the end boundaries as a base line and put in a stake at every 35 feet. Measuring down the hill, he should check up his distances to see that each was exact. Each stake so set would mark the end of a row. The same measurements should be made up and down the hill on the other border of the piece. Using these end stakes as fixed points, a row of stakes could be sighted in between to make a straight line. The plow could then be started and a perfectly straight furrow, practically parallel with the hillside, put in from this line of stakes. As the plowing proceeded, a second row of sighting stakes should be set up to mark the next row to be plowed. In proceeding in this manner, the whole piece would be laid off in
exactly parallel furrows, running approximately parallel with the hillside. By making two rounds in each furrow the soil would be sufficiently plowed out, so that there would be very little more dirt to be thrown out with a shovel in planting the trees. In the highest and lowest furrows parallel stakes are set at every 35 feet. This marks the position of the trees in the first and last rows. From the second stake below a wire is reeled out and the end fastened tight to a stob driven in place of the second stake in the upper row. The wire is drawn tight between these two points and then slackened gradually till it conforms to the slope of the hill and rests on the ground in a straight line. Where the wire crosses the bottom of each parallel furrow will mark the spot where a tree is to be planted. The setting of the trees can now begin. While one man is distributing trees up or down the hillsides along the wire other men with shovels can be throwing out any extra dirt to make a proper hole for planting the trees. The wire can then be moved over the next two stakes, and planting of the next row proceed in the same manner. A bright wire affords a very handy means of marking out the rows, for in the sun it shows like a silver ribbon and can be seen perfectly even throughout a long stretch of land. If the land is steep the same method can be used, but instead of measuring off the 35 feet (the distance between two trees) on the slope it would be best to use a plumb line and level up, so that the 35 feet would be measured on the level instead of on the slope. On steep slopes, if some correction is not made for grade, it will be found that the rows are too close together. If the land is not too irregular, trees set out by this method will be found to 'checker up' pretty well every way."

In digging the holes use a short board, as shown in Fig. 2, which has a notch in the center and a hole at each end, equi-distant from the center of the notch and on a line with it. Before beginning to dig place the board over the stake so that the center of the notch is in the position the tree is to occupy and put a peg through each hole in the ends. Remove board and center stake, but leave the outer pegs. Dig the hole and place the board back over the pegs and place the tree in the center of the notch.

Buying the trees.—When possible to do so purchase trees directly from the nearest reliable nursery firm. The proprietors of such nurseries should furnish good trees at lower prices than the same goods can be had through an agent. The honest agent whose credentials show that he is doing good business for a reputable nursery is to be encouraged. Have no dealings with the unreliable tree peddler who is abroad in the land deceiving the people with exaggerated pictures, who buys up cull stock and mixed lots of seedlings not infrequently affected with diseases and insect pests, who represents such goods to be some new and superior fruit, and who sells his stock at several times the price our best nurserymen ask for first-class trees.

Nurserymen doing business in the state must have a certificate of inspection. Buy trees that have been inspected for dangerous parasites and look for certificate of inspection on the package.

Trees one year old from bud or graft are usually the proper age to plant, but some slow growing sorts may be two years old before planting. Under no circumstances should trees over two years old be planted for they receive a greater check in transplanting than younger trees and do not make as good growth. They are more likely to be broken in digging and packing and the cost of transportation is greater. Young trees can be pruned and trained to suit the ideals of the grower better than older trees for they will not have large branches on them.

Planting the trees.—Trees should be planted in the fall in the South as there is no danger of winter-killing from freezing and they start off better in the spring. The wounds heal or callus over and the roots are ready for work as soon as spring comes. By planting in the fall we avoid the rush of spring work. However, successful plantings are frequently made during mild weather in winter and as late as March 1st.

The distance for planting apple trees is not so great here as in the North, since the trees do not grow as large here as there. For most varieties 25 to 30 feet is sufficient. The tendency is toward closer planting than formerly in all sections of the country.

Too much care cannot be given to this important operation. No matter how well the land is prepared, nor what classes of trees one has, if they are not well planted best results will not be secured. Planting a tree does not consist simply in digging a hole and placing the tree in it and then filling the hole. Many trees are planted that way
and as a result they die the first year. Before planting, the tree should be pruned—both roots and branches. Cut off all broken and mangled roots and cut back roots that are too long to be well accommodated in the hole. Cut the root from the under side so that the cut surface will lie in contact with the soil below. Cut off all the branches except three or four scaffold branches which are to form the frame work of the tree and cut these back to about 8 to 10 inches. These branches should be well distributed up and down and around the trunk as shown in Fig. 3. The head should be formed low (18 inches from the ground) as it will then protect the trunk from sunscald, be more easily pruned and sprayed, and the fruit more easily gathered. A low headed tree is not so liable to be broken by windstorms as a high headed tree.

When the trees are pruned and ready to plant it is a good plan to "puddle" the roots by dipping in a thin mud paste. This paste is made by mixing clay with water in a tub or barrel and is carried along on the wagon with the trees. Never allow the paste to dry on the roots before planting. Having the tree ready for planting throw in a little fresh soil and place the tree in the hole so that the graft is below the surface. Spread out the roots and throw in good fine soil, working it in around the roots with the hands. Pack the soil well by tramping until the hole is full, then put a little loose soil on top to prevent baking. Never cramp the roots, but have holes large enough to accommodate all but the longest.

Cultivation of the orchard.—Within recent years there has been considerable discussion of the best methods of culture for apples especially with reference to clean culture and sod mulch systems.

The clean culture method consists simply in keeping the land well cultivated during the growing season. This method is objec-
tionable because it leaves the land bare over winter and this allows
the soil to run together and to wash badly. Plant food is also lost
by this method as the tree ceases to grow before the summer is over
and plant food which becomes available is lost by leaching or by being
washed away.

The sod mulch method consists in having the orchard covered
with sod and mulching the trees either with grass cut therefrom or
with some other material. The objections to this method are that
it takes up moisture and plant food needed by the trees and the mulch
harbors disease organisms, insects, and rodents. With the exception
of the matter of plant food these are legitimate objections. If the
grass is left on the ground, as it should be, the plant food is returned.
This method is justifiable on land that is subject to washing, and is
even practiced very successfully on level land. One of the best or-
chards the writer has ever seen was in sod and had been all its life.
The land had been a blue grass pasture for twenty years before the
orchard was planted and now, forty years later, the sod has never
been broken. Large holes were dug and after the trees were planted
they were mulched with straw. All the grass that grew was cut down
and raked up around the trees and other material was added when
it could be secured. Nothing has ever been removed from this orchard
except the fruit and a great deal of humus and plant food has been
added.

Probably the best method for most soils in Mississippi would
be a combination of clean culture and cover crops. The orchard
should be well cultivated up to about midsummer, then sown down
to cowpeas or some other leguminous crop. The cover crop takes
up surplus plant food, takes up moisture in the fall, which causes the
trees to mature their wood before winter, keeps the land from washing,
and when plowed under during spring adds humus and nitrogen to
the soil. Should nitrogen be plentiful in the soil a non-leguminous
crop should be grown such as oats, rye, or rape, and these should be
sown in the early fall.

Cropping the orchard.—The cropping of an orchard with other
crops for purposes of revenue is justifiable only when the trees are
young and do not need all of the space, and should be discontinued
when the trees begin bearing regularly. The farmer is often forced
to grow other crops to pay the expenses of the orchard before it begins
to bear and, when this is done properly, it does not have had effects.
As cropping is commonly done, however, trees are starved and crowded
The cause of the injury is that the grower neglects his trees and crops the orchard too heavily. When this method is followed nothing but cultivated crops should be used and then only those that are heavily manured, such as Irish potatoes, cabbage, or other garden crops. Grain and hay crops should not be removed from the orchard. Often the trees will get better cultivation by cropping the orchard than they would get otherwise as the farmer is likely to neglect the crop that does not bring in money. When planting the crop in the orchard as much as three feet should be left on both sides of the tree the first year and this space should be increased each year. Finally, there would be just a narrow space in the center between the rows that would be cropped. Whatever crop is grown the soil should be left in better condition after it is off than before it was planted. The cropping system is one that the writer hesitates to recommend because so many orchards are killed by heavy cropping. The grower is inclined to sacrifice his trees for the other crop because it is bringing in returns, whereas the grower should always have the welfare of his trees in mind and give them first consideration.

The system to be followed is the one that gives the best results in growing a crop of trees and fruit. Any method mentioned will be successful if the grower has the welfare of his trees in mind and makes everything else subordinate to them.

Fertilization of the orchard.—If the trees are growing vigorously and the foliage is of a bright green color no fertilizer will be necessary, but if they are stunted and the foliage is of a sickly yellowish color plant food should be added. The apple being a heavy feeder, cannot be expected to produce large crops of fruit indefinitely without the addition of fertilizers. Nitrogen, phosphoric acid, and potash may all be needed, but the nitrogen can be most economically supplied by planting cowpeas or some other leguminous crop. Phosphoric acid can be supplied in commercial fertilizers in the form of acid phosphate, or rock phosphate, and potash in the form of muriate or sulphate of potash. For most Mississippi soils potash will not likely be needed as it seems to be abundant in all soils that have been tested. The fertilizer should be applied in the spring when it can be taken up by the tree. Apply broadcast over the soil and harrow in or apply around the tree as far as the branches extend and work into the soil.

Pruning.—The tree that is properly pruned during the first two or three years of its life in the orchard will require very little severe pruning later on. The scaffold branches are selected at planting time or
the following season. These should be so pruned, after the first year, as to form an open head to permit free circulation of air and admit abundant sunlight. To secure this form the branches which grow toward the center are cut off and those growing from outside buds are left. Always remove one of the branches where two are growing close together. Where it is necessary to remove large limbs great care should be exercised to prevent splitting the branch or tearing the bark on the trunk or supporting branch. This can be accomplished by sawing part way through from the under side of the limb a foot or so from the supporting branch, then sawing from the top an inch or two in front of the under cut. After the branch is cut off the stub can be sawed off smoothly up near the trunk.

In all pruning the cut should be made as near the supporting part as possible, but the wound should be as small as it can be made; therefore, make the cut at right angles to the branch rather than parallel to the trunk. Large wounds should be covered with some antiseptic material which will keep out water and disease germs. Thick white lead paint or coal tar can be used for this purpose. If the wound does not heal over the first year give it a coat of paint or tar each succeeding year until it heals.

Pruning for fruit.—Where trees are in a healthy, growing condition and are not fruiting, pruning to check growth will stimulate fruit production. On the other hand, pruning may be used to prevent over-production when necessary. The fruit of the apple is borne on fruit spurs which develop from wood one year or more of age. By removal of some of these spurs, the trees are prevented from over bearing. Cut out all older spurs and those on the interior of the tree where there is insufficient light to give good color to the fruit and remove those from the trunk and larger branches. In removing such spurs we are protecting the tree from blight, which enters largely through the blossoms and soon passes back into the supporting branch. The remedy is to remove the diseased portions, but where the large limbs are affected this could not be done without serious injury to the tree. When the blight enters the smaller branches they can be removed without much loss.

Pruning implements.—As pruning leaves wounds on the tree it is desirable to have the cut surface as smooth as possible and the implement used should be the one that leaves the smoothest surface. For very small branches the pruning knife gives best results and for the next size the hand pruning shears. Branches too large for either the knife or hand shears can be removed with the lop shears, but
those over three-quarters of an inch in diameter should not be cut with the lop shears as they crush and injure the bark. For branches above this size use a pruning saw or a good hand saw. Wounds made by a saw are often dressed off smoothly by the use of a chisel, and this hastens healing.

**Insects and diseases of the apple.**—The apple is attacked by many diseases and insects and unless some protection is given first class fruit cannot be grown. Among the worst diseases are the bitter rot, apple scab, apple rust, fire blight, and crown gall. The principal insect enemies are the San José scale, round-headed and flat-headed apple-tree borers, codling moth, tent caterpillar, fall web-worm, canker worm, and bud moth. It is not likely that all these diseases and insects will be present at one time, but the grower should be able to recognize them so as to know what treatment to use and the time of application.

**Spraying.**—Spraying is one of the most important operations connected with the growing of apples and success depends largely on the proper application at the proper time and on the thoroughness of the work. As bitter rot is the worst enemy of the apple in most regions of Mississippi the later applications of a fungicide are very
important. During the season of 1910 the writer carried on experiments in controlling diseases and insects of the apple. In this work it was found that spraying at intervals of about two weeks from the time the fruit was half grown until it began to ripen controlled the bitter rot. The applications made before the fruit was half grown had little effect upon this disease, but was important in keeping the apple scab and other diseases in check. The writer suggests the following treatment for the apple based upon the past season's work and on general knowledge of the diseases and insects found working on the apple in Mississippi:

1. Spray with lime-sulphur wash during the winter if scale insects are present.
2. Spray with copper sulphate solution before buds open if the lime-sulphur wash is not applied.
3. Spray with Bordeaux mixture and arsenate of lead after leaf buds open but before flower buds open. This is for diseases or insects that affect the foliage early in the season.
4. Repeat No. 3 just after the petals drop. This is the important application for the codling moth and great care should be exercised to get the calyces of the young fruit filled with the mixture so that the insect will get a dose when he begins feeding. These insects enter the fruit largely from the calyx end.
5. Repeat No. 3 two weeks after No. 4.
6. Spray with Bordeaux mixture at intervals of about two weeks from the time the fruit is half grown until it begins to mature. These applications are absolutely essential to keep the bitter rot in check and unless this is done the fruit will be of little value.

Six or seven applications during the season will control all of the common diseases and insects found in Mississippi if these applications are made at the proper time. Trees sprayed six times during the past season yielded from 95 to 98 per cent perfect fruit (see Fig. 5) while those not sprayed at all or sprayed only once or twice early in the season gave about 95 per cent imperfect and unsound fruit. The difference between spraying and not spraying means the difference between profit and loss.

Note.—While Bordeaux mixture completely controlled the diseases it caused some russetting of the fruit and is somewhat objectionable for this reason. Experiments carried on in different parts of the country seem to indicate that the commercial brands of lime-sulphur
FIG. 5. Apple tree when fruit is nearly ripe. This tree was sprayed six times, and produced 95 per cent perfect fruit and held its foliage.

or the home-made lime-sulphur mixture will control the diseases of the apple without injuring the fruit. This work is not conclusive, however, and the writer would hesitate to recommend these mixtures until they have been further tried and proven without doubt. For formulae and method of preparation of the mixtures recommended in this bulletin, see bulletin 141 of this Station.

In addition to spraying it will be necessary to give the trees other attention in order to control diseases and insects. The apple tree borers cannot be reached by any insecticide so must be controlled by other means. The best method is to watch for the sawdust like castings around the base of the tree and then locate the burrow and dig out the insect with a sharp knife or kill it by running a wire in the hole and crushing the larva. If the trees are examined twice a year these insects can be kept in check with little expense or time.
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The following bulletins and circulars of the Station may be had on request:

**BULLETINS.**

- No. 60—Value of Cotton Seed to the Farmer.
- No. 83—Report of Work at McNeill Branch Station for 1903.
- No. 84—Report of Field Work at College Station for 1903.
- No. 90—San Jos Scale.
- No. 91—Inspection and Analyses of Commercial Fertilizers.
- No. 92—Beef Cattle.
- No. 93—Peach and Plum Culture.
- No. 95—The Dairy Cow.
- No. 100—Farmers' Institute Bulletin, 1906.
- No. 104—Inspection and Analyses of Cotton Seed Meal.
- No. 107—Pork Production at the Delta Station.
- No. 114—Inspection and Analyses of Cotton Seed Meal.
- No. 119—Report of Work at the Delta Branch Station for 1907 and 1908.
- No. 121—Experiments in Feeding Beef Steers.
- No. 125—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 127—Inspection and Analyses of Cotton Seed Meal.
- No. 128—Inspection and Analyses of Cotton Seed Meal.
- No. 129—Sugar Cane for Syrup Making.
- No. 132—The Soils of Mississippi.
- No. 133—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 134—Broom Corn.
- No. 135—Cotton 1909.
- No. 136—Feeding Beef Steers on Cotton Seed Meal; on Pasture.
- No. 137—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 138—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 139—The Boll Weevil in Mississippi, 1909.
- No. 140—Cotton Diseases in Mississippi.
- No. 141—Control of Disease of Fruits, Flowers and Vegetables.
- No. 142—Inspection and Analyses of Commercial Fertilizers.
- No. 143—Inspection and Analyses of Cotton Seed Meal.
- No. 144—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 145—Inspection and Analyses of Commercial Feeding Stuffs.
- No. 146—Suggestions for Growing Home Fruits.
- No. 147—Apple Growing in Mississippi.
- No. 148—Inspection and Analyses of Cotton Seed Meal.
- No. 149—Inspection and Analyses of Commercial Feeding Stuffs.

**TECHNICAL BULLETINS.**

- No. 2—Some Scale Insects of Mississippi and Texas.

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- Asparagus.
- Blackleg.
- Boll Weevil.
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- Underground Waters of Mississippi.
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