

Russia. During a number of years after his coming to America, Mezitt gained valuable experience while working as gardener and foreman on estates near Boston. But all the while, he had his mind set on starting a nursery of his own, which he did in Weston a little while before the depression of the thirties.

Edmond, the son, grew up in the nursery business and topped practical experience with professional training in landscape architecture, in which he was graduated at Cornell University in 1938. Father and son have developed one of the largest and finest nurseries in the Northeast, that does an annual gross business valued at \$350,000 to \$500,000.



Diversion ditch on Weston Nursery.

Ridge Farming for Erosion Control

No. 15

This is the fifteenth of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

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AGRICULTURAL scientists are continuously seeking tillage systems which embody the best soil and water conservation principles without sacrificing yields. To be acceptable a system, in addition to providing year-round protection for the soil, must assure adequate yields and provide for efficient use of labor and machinery. In their attempt to find such a system United States Department of Agriculture and Iowa Experiment Station agricultural engineers and agronomists have been studying tillage systems.

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Such questions as follows are still asked of each system: Does the system control water runoff? Does the tillage system prevent soil erosion? Does the system provide for above ground water storage? Does it prevent soil blowing? Can it work on slopes and flat ground?

One of the most promising tillage systems developed has been called ridge farming. This system is somewhat similar to contour listing except the crop is planted on the ridge instead of in the furrow. By planting on top of the ridge the best features of listing, bedding, and conventional farming are combined.

A review of corn production literature shows that Jones and Beasley at the Missouri Experiment Station experimented with ridge farming for 3 years starting in 1938. Yields were low but this was offset in part by lower requirements in power and labor. The experiments were abandoned due to lack of machinery to construct ridges and to cultivate and control weeds on the ridge.

Contour listing has been used for a number of years in western Iowa and eastern Nebraska. Experiments in western Iowa show that contour listing reduces soil loss to $\frac{1}{3}$ and water runoff to $\frac{1}{2}$ that of surface planting.

Ridge farming as now practiced consists of planting on contour ridges, preemergence spraying to control early weed and grass growth, and mechanical cultivating to control late weed and grass growth. The ridges are maintained throughout the year and all cultivations are conducted to maintain or increase the size of the ridge.

Many new herbicides have been developed that show promise for controlling weeds in row crops. Several years of experiments in Iowa, using 2,4-D as a preemergence spray application, have indicated that it gives excellent control of early annual grasses and broad-leaved weeds. This spray applied at planting time retards the growth of annual grasses and prevents the growth of susceptible broad-leaved weeds for a period of 4 to 6 weeks.

Experimentally a 5 year rotation of corn, corn, oats, meadow, meadow, has been followed on ridges. This is feasible if the small grain and meadow crop can be direct harvested. Two years of corn grown on ridges with small grain and meadow crop flat planted is practical because the ridges can be leveled with one pass of disk cultivator by setting the disks to throw out, or with two passes of a tandem disk used in the conventional manner.

The laying out of the ridges is of special importance as they will be maintained throughout the year and possibly for two or more years. If the field has already been terraced then it is relatively simple to lay out the ridges. They are formed starting at the top terrace ridge and working down the slope parallel to it. At the

end of the row the ridges are turned down the hill and the return pass is made parallel to the first ridges. When the lower terrace channel is reached the ridges are ended in the terrace channel. The terrace channel is seeded to grass in areas where it is used for turning. A seeded or surface planted area is required at the row ends for turning purposes. Existing waterways are used in this layout.

If a field has not been terraced a contour or graded line is located at or near the top of the slope. If the line is on the contour it should be located as close to the top of the hill as possible. A 3 to 5 foot vertical interval is permissible from the top if a .4 to .5 percent graded line is used and if reverse grades do not occur in the furrows constructed above and parallel to this line. If reverse grades are found in furrows, less vertical distance between contour control lines is used. Use is made of all natural waterways and new waterways are established to have a turn strip at row ends to avoid turning machinery across the ridges. This turn strip may be a waterway, a grassed area, or a surface planted area.

A rope is used to walk in a parallel line with a 5 to 7 foot vertical interval down the slope from the top graded or contour line. If the grade of this line is too great, (4 inches of fall in a row 100 feet long is considered maximum) a shorter vertical interval is used by moving up the slope.

After the new contour or graded line is laid out, a 30-foot grass correction strip is established below it. Ridges are constructed below and parallel to the lower side of the grassed strip. This process is repeated until the bottom of the slope is reached. All row ends are turned down the slope to avoid catching runoff water. All short rows are ended on the lower correction strip.

The ridge farming system has been used on three farms on a field basis. Sufficient waterways and correction strips were used to prevent excessive grade in the furrows, break up row length, and give good control of the water. The correction strips provided a convenient place for turning when short rows were encountered. The number of correction strips used on long slopes varied from 2 to 4, depending on the terrain.

Ridges may be constructed with a disk culti-



A field of mature, ridge farmed corn.



Water standing in contour ridge farmed field after 1½-inch rain.

vator or a plow. If a disk cultivator is used the field is first plowed and the ridge formed with two 16-inch disks operating on each side of the bed. After the first pass has been made over the entire field the center two 16-inch disks are removed and replaced with 12-inch disks. Another pass is then made over the field to increase the height of the ridges. Sweeps may be used in the furrows on both the first and the second pass to plow out the soil left by the two center disks and to loosen the soil in the furrows so that the soil may be easily moved during succeeding operations.

If the ridges are constructed with a plow, the bottoms are arranged so that 1 furrow slice is inverted onto an undisturbed strip approximately 2 furrow slices wide. With the proper tractor wheel spacing, uniform ridges can be constructed on 40 or 42 inch centers. The furrow walls are used as a guide for the tractor wheels. Wide front end tractors are easiest to use for this operation. Nearly all plows can be modified to make ridges. With this method of constructing ridges approximately one-third of the land is plowed. However, it is usually necessary to make one pass with a disk cultivator to break up large clods, shape the ridges, and control weeds prior to planting.

If the ridges are formed in the fall, they may need another disk cultivation in the spring. This operation should be made near planting time so that early weeds that have germinated in the ridge before planting will be controlled.

Forming the ridges in the fall helps catch snow and provides above ground storage of water until the soil has thawed sufficiently to absorb the water which accumulated from winter rains and melting snow. A 10-inch ridge on level land will have approximately 5 inches of above ground water storage capacity. On sloping land with irregular layout, however, this storage capacity is reduced to 1½ to 2 inches of water.

The ridges are planted either with a centrally mounted planter equipped with single disk furrow openers or a trailing planter with disks to hold the planter on the ridges. The disk furrow opener cuts through any trash found in the ridge. (Stalks caught on a stub runner will scrape off the top of the ridge and reduce the height of the ridge.)

If the soil is dry the planter is run into the ridge deep enough to place the seeds in moist soil. The height of the ridge must often be reduced in order to do this. The conventional open centered press wheel has been satisfactory

for firming the soil over the seed.

After planting, the entire land surface is sprayed with $11\frac{1}{2}$ pounds of 2,4-D ester mixed with 10 gallons of water. This preemergence spray may be applied at time of planting or at any time until the corn plants emerge. Spraying after the corn has emerged will often cause serious damage to the corn plants and reduce yields. The 2,4-D provides effective weed control until the corn is about a foot high.

The annual grasses that have been stunted by the 2,4-D spray will begin to recover 4 to 6 weeks after spraying and make rapid growth. A cultivator equipped with disks should be used at about this time for the first cultivation. Because of the height of the corn this cultivation may be performed at high speeds. The disks are set to throw the soil up hill onto the ridge and are staggered for better weed control. A second cultivation may be necessary, depending on the extent of weed infestation. If used, the front disks are moved further apart in order to prevent root pruning. For all cultivations sweeps are used in the furrows to plow out tractor wheel tracks and loosen the soil for maximum water infiltration.

Physical and chemical measurements were made of the soil and the root bed of ridge farmed corn. These measurements were compared to flat planted, and lister planted corn. The temperature at seed depth at planting time



A four-row, variable width ridge making unit used on sloping land.

was found to be slightly higher in the ridge than on the flat surface and from 3° to 6°F higher than in the lister furrow. The moisture content of the ridge was found to be less than flat planted or listed corn at the seed level; however, at greater depths the ridge had a higher moisture content than either the flat surface or lister furrow. The bulk density of ridge and lister furrows were approximately the same throughout the soil profile. The traveled furrows between ridges were found to be much higher in bulk density than that of the lister furrows or untraveled furrows. The available nitrate content of uncultivated soil samples was higher from the ridge than from the flat surface or the lister furrows.

Observations were made on the differences between the infiltration capacity of traveled and untraveled furrows. Wide front end tractors were used in the farming operations. Although water may flow horizontally from a compacted furrow to an uncompacted furrow and in that manner flow into the soil, the fact still remains that the only water loss from the ridged field was lost from the traveled furrows. This plot was compared with an adjacent flat planted plot. While no water was found standing in the sloping flat planted field, three areas were found where erosion had occurred. The erosion had washed out numerous hills of corn, reducing the stand and carrying soil from the field.

Another benefit is gained from the efficiency



Ridge plowing with 4-bottom plow that has the 2 center bottoms removed.

of tractors operating on graded or contour rows. Operating the tractor on the contour permits maximum loading of the tractor in that the tractor does not have to pull itself up hill and then coast, so to speak, downhill under its own weight. The ridge-furrow combination provides an accurate steering guide for machinery operations. The front wheels of the tractor tend to follow the furrows. The ridges prevent sidehill slippage of the tractor during cultivation. This minimizes the careful attention normally required for the first cultivation of contour rows and permits higher operation speeds in later cultivation. Often it has been observed that good emergence has been secured on contour flat planted slopes; yet, the difficulty of steering on loose soil on sidehills has resulted in the plowing out of many corn seedlings.

Making the ridges with the disk cultivator or plow permits the accumulation of topsoil in the seedbed. This is especially beneficial in thin land.



Disk cultivator set to cultivate ridge farmed corn.

On level poorly drained land the elevated seedbed of the ridge provides a certain amount of protection against drowning of the crop during flooded conditions. Furrows opening into drainage ways provide a drainage ditch 4 to 5 inches below the normal soil surface. Drainage problems occur most often in soil depressions or on relatively flat land. Ridges located on the sides of a low area prevent accumulation of excess water in this depressions by preventing water from flowing into the depressions. On

level land the height of the seedbed helps to avoid drown outs because, even if the land is flooded, the period of drowning is reduced because the top of the ridge emerges first after the water recedes. The reduction of the drowning period prevented drowning of ridge planted crops during the 1951 and 1954 crop years.

In a number of sloping fields, however, overtopping of the ridges during heavy rainstorms was observed. In areas where back slope occurred, the water accumulated in the furrow until water began to run over the top of the ridge into the next lower furrow. This overtopping occurred successively downslope, causing the eventual failure and washout of a number of ridges. The soil washed from a ridge was found deposited in the next lower furrows. The ridges successively failed downslope until a furrow or a number of furrows were reached that had good drainage to a waterway. When these furrows were reached, the water flowed to the waterway and failure of the entire slope was prevented.

Experience has indicated that the ends of the row should be turned downslope to provide drainage of the furrows into the waterway. If the furrows are not turned downslope then when the ridge forming equipment is pulled out of the ground, a pocket is formed which prevents drainage of the furrow during heavy rains.

During the development of the ridge farming system, yield data were collected. In general, the yield of ridged and flat plots have been approximately the same. There was a greater difference in yield during the first years of development than in later years. In some areas where listing is recommended, the yields of ridged and listed corn have been approximately the same. Where listing is not adapted, however, yields of listed corn have been below yields of ridge planted corn.

SOIL STEWARDSHIP.—Reports from Alabama show that 499 sermons were preached on soil stewardship during Soil Stewardship Sunday in 1955, with an approximate attendance of 46,049 people. In addition, numerous news articles were published and radio broadcasts presented.