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What About Continuous Corn?

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Interest in continuous corn in Iowa has been growing for several years. And increasing numbers of farmers have been trying it out on their own. Here's a report on the results of our Iowa tests with continuous corn.

by W. D. Shrader, John Pesek and W. C. Moldenhauer

CORN REMAINS Iowa's most profitable major crop. And more and more Iowa corn growers are moving into a "corn-following-corn" or *continuous corn* cropping program. Both actual practice and experimental work have indicated that it's possible to get good corn yields when corn is grown continuously on *some* of the state's soils.

Continuous corn is most feasible on more or less level areas where erosion isn't a problem. But it's not now feasible to control erosion under continuous row-cropping on slopes of more than 5 percent. And, even on gentle slopes of only 2-5 percent, erosion can be controlled only with special practices.

Before we get into specifics, however, let's look briefly at some of the prospects for and implications of continuous corn for the state. What does it or could it mean to Iowa farming?

Its Meaning . . .

Since corn is our most profitable major grain crop and since a shift to continuous corn permits an individual to increase his corn production, we can expect more and more farmers on nearly level soils to adopt the practice. On farms with both level and rolling land, a shift to continuous corn is likely on the level land and one to continuous meadow, pasture or rotation cropping on suitable rolling land.

On farms with only rolling land, there's likely to be little effect, unless farmers attempt to grow continuous corn on the rolling land. In this case, erosion damage will be increased.

Wisely used, this technique can increase the relative wealth of Iowa and improve the competitive position of Iowa farmers as compared with farmers in other parts of the country. Used unwisely, it could result in accelerated erosion and in serious land deterioration.

Also, land suitable for more intensive row-cropping tends to be concentrated in the northwestern, north-central and northeastern parts of the state. Continuous corn in these areas, therefore, could lead to an even wider disparity of incomes among farms in different parts of the state. This, in turn, could mean that land values for the more level land might increase still more rapidly than those of rolling land.

Another problem we must recognize is that corn production in total already is in surplus. Continuous corn generally means more total production from a farm. And a large increase in total production from many farms could further depress corn prices. On the other hand is the fact that—because of nature—many individual Iowa farmers and the state as a whole have an advantage over many of the other corn-producing areas in having a relatively high proportion of land suitable for continuous corn.

Interest in the possibility of continuous corn in Iowa has been growing for a number of years, and increasing numbers of farmers over the state have been trying it out on their own. Here, now, are the specific results of our experiments.

It Can Be Done

As shown on page 5, yields of continuous and of rotation corn have averaged about the same at six locations over the past 6 years. In another experiment at the Agronomy Farm near Ames, one set of plots has been in continuous corn since 1915. When adequate fertilizer was applied, starting in 1952, yields on these old continuous corn plots shot up to levels as high as the rotation corn.

Use of 160 pounds of nitrogen and 60 pounds each of P_2O_5 and K_2O per acre annually increased average corn yields from 41 to 92 bushels per acre in the 1953-59 period. Eighty pounds of nitrogen *with* P_2O_5 and K_2O gave 81 bushels, but the same amount of nitrogen *without* the other two

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It isn't now feasible with continuous row-cropping to control erosion on slopes of more than 5 percent. And special practices for erosion control are needed on gentle slopes of only 2-5 percent.

nutrients yielded only 73 bushels. The most profitable annual rate of nitrogen in this experiment was about 120 pounds per acre. We estimate that a long-time annual rate of 30-40 pounds each of P_2O_5 and K_2O would be adequate to achieve these yields.

In the work with continuous corn at Ames, it was easy to push continuous corn yields to high levels. But, as shown in the table, this isn't always the case. Continuous corn yields at the Pasture Improvement Farm and at the Grundy-Shelby Farm have remained lower than yields of rotation corn. At the Albia location, it has taken several years to build up the fertility level on the depleted plots, and yields were up for the first time in 1959. In 1959 at Albia, rotation corn yields averaged 109 bushels per acre as compared with 102 bushels for continuous corn.

Continuous corn appears most feasible on medium-textured soils in more or less level areas where erosion is not a problem. Most of such land is in northwestern, north-central and northeastern Iowa.

What Soils?

Most of our work with continuous corn has been on more or less level areas of medium-textured soils. Continuous cropping to corn or soybeans should not be attempted on moderate-to-steep sloping areas of more than 5-percent slope. It's not feasible to control erosion with commonly used cultivation practices.

On gentle slopes (2-5 percent) continuous cropping should be attempted only after careful thought and attention to the erosion hazard. Usually, at least contouring or terracing and contour cultivation are necessary practices. Again, the areas in which continuous row-cropping seems most feasible are the areas of nearly level medium-textured soils.

How Much Land?

About 28 percent of all land in Iowa has slopes of less than 2 percent. Of this 10 million acres, perhaps as much as 7 million are medium-textured cropland. Of this area of most suitable soils, a considerable portion is made up of areas too small to be farmed separately or is in roads or farmsteads. We can't say exactly, therefore, how much land could be safely and feasibly used for continuous corn without special erosion-control practices. But it would be appreciably less than 7 million acres.

Another 31 percent of Iowa land is on gentle slopes of 2-5 percent. These slopes can be used for continuous corn if suitable erosion-control practices are used. Of the 11 million acres of land with these slopes, perhaps as many as 5-7 million might have soil suitable for continuous row-cropping. As on the level land, the acreage of suitable fields would be considerably less than the total acreage.

With all possibilities considered, it appears that from 5 to 10 million acres of Iowa land could be used for continuous corn production. It is, therefore, a very important production possibility. There are many more acres —

some 14-20 million — of cropland on which continuous corn production doesn't appear to be feasible. So, on more than half of our cropland, some type of rotation or permanent vegetation still seems essential.

Fertilizer Needs . . .

The main feature of fertilizer needs for continuous corn is the need for additional nitrogen. About 80-120 pounds per acre annually would be needed if corn were grown continuously on soils of average fertility. First-year corn following a good legume meadow requires little or no fertilizer nitrogen.

Because of the higher average value of product produced per acre, it's profitable to maintain a field in continuous corn at a higher level of fertility than a field in a rotation with oats and hay. Carryover residues of phosphorus and potassium fertilizers are relatively high, and different crops remove different amounts of these from the soil. We estimate that, over a period of years, a field of corn, if the stalks aren't removed, will use significantly less potassium and about the same amount or slightly less phosphorus than a field in a rotation with oats and hay.

Effects on Soil . . .

Many studies indicate that there usually has been a decline in soil organic matter and soil structure under intensive cultivation. Most of these studies, however, were made under conditions of low fertility. The rate of decline in organic matter and soil structure could be expected to be less when large amounts of organic residues are produced as is the case with correctly fertilized corn. And the limited amount of work that has been done under conditions of high fertility indicates that the organic matter level and soil tilth can be kept at satisfactory levels for crop production with continuous corn.

Water Use . . .

While there's not much difference in drouth hazard for rotation corn as compared with continuous corn, the hazard is slightly greater for rotation corn. This is because the growing corn must depend on soil or subsoil moisture supplies for periods of a week or longer nearly every season. And the chances of having a large soil moisture reserve are better following corn than following meadow.

Corn, for practical purposes, ceases using moisture during the last half of September. Water use by deep-rooted perennial legumes continues until they're plowed under or go dormant. And they resume water use in the spring if not plowed under.

The results of soil moisture studies in recent dry years indicate more available water in soils previously in corn than in soils previously in legume meadow. Thus, continuous corn would tend to reduce the year-to-year variations in corn yields that result from seasonal differences in rainfall.

Drainage . . .

Any benefits in drainage that may result from including a deep-rooted legume in a rotation are believed too slight or too limited in the soil conditions to which they apply to be of serious concern. There's much, however, that isn't known on this subject, and our studies are continuing.

Weeds, Insects, Diseases

Continuous corn wasn't feasible even on level land in many areas until soil insecticides were introduced to control soil insects attacking corn seed and roots. The use of modern chemicals and cultural practices permits weed, insect and disease control in either continuous or rotation corn. Some weeds and insects are easier to control in a rotation, while others may be easier to control with continuous corn.

There are no serious plant diseases threatening the Iowa corn crop at present. But corn grown continuously "invites" a buildup of soil-borne diseases, and growers will have to remain alert for signs of damage.

Other Factors . . .

The growing of a single crop tends to concentrate the demand for labor and equipment and to increase the risk of financial loss in case of either crop failure or a low price for corn. On many farms, however, there may be an opportunity to increase the intensity of cropping on level land while decreasing effort and intensity on the more rolling portions of the farm. Such a shift could lower the costs of producing both corn and hay and would tend to overcome the risk we just mentioned. Total farm product could increase since the low-yielding oat crop would occur less frequently, if at all.

While the demand on equipment and labor would tend to be aggravated, the supply of equipment and labor talent wouldn't need to be as diverse. A corn farm, for example, wouldn't need a hay baler, a grain combine, etc. Money saved here might be put into more or larger equipment for corn production.

Relative 1953-1958 average yields of continuous and rotation corn at six Iowa locations.

Location	Average yield (bu./A.)		Yield of continuous corn as a percentage of rotation corn
	Rotation corn	Continuous corn	
Carrington-Clyde Farm, Independence			
Rotation experiment	98	99	101
Runoff experiment	102	97	95
Soil Conservation Farm, Clarinda	75	77	102
Pasture Improvement Farm, Albia	72	58	81
Southern Iowa Farm, Bloomfield	96	105	110
Seymour-Shelby Farm, Seymour	76	80	105
Grundy-Shelby Farm, Beaconsfield	78	71	92
AVERAGE	85	84	98