

The use of land in the Corn Belt.

Here is grown about 40 percent of the world's corn. The future of this section will reflect the balance between demands for livestock products and the greater production that science is bringing. The march of technology, which has meant mounting investments in modern equipment and materials, may increase the Corn Belt's advantage in the production of corn and livestock. By *C. W. Crickman*, Northern Field Research Section, Farm Economics Research Division.

THE CORN BELT centers in the middle Mississippi River Valley. It is bounded on the east in Ohio by the foothills of the Appalachian Mountains and on the south by the rough topography along the Ohio River and the Ozark uplift in Illinois and Missouri. Its western and northern boundaries are established by the dry weather of the Great Plains and the short growing season and cool summer nights of the Lake States.

Land in the Corn Belt is generally level or gently rolling. The deep, warm, fertile soils are rich in organic matter and nitrogen. They are well adapted to the production of feed grains, soybeans, grasses, and legumes. Sufficient rainfall, well distributed throughout the growing season, hot days, and warm nights are also ideal for these crops.

To have level topography, fertile soil, generous rainfall, and favorable temperatures combined in so good a balance is rare. In fact, of the 100 million acres in the United States that soil technicians describe as excellent for grains, grasses, and legumes, about three-fourths are in the Corn Belt.

The Corn Belt is well named. The deep, black soils and the climate are nearly perfect for corn. The soils have the desirable characteristics of friability, aeration, water-holding capacity, and plentiful nitrogen.

The relatively flat topography permits an intensive corn-cropping program with modern laborsaving machinery. About three-fourths of the corn harvested for grain in the United States and about 40 percent of the world's output of corn are grown in the Corn Belt.

But the corn crop draws heavily on even the abundant fertility of the soil. It is particularly seasonal in its use of labor and equipment. To protect or replenish the structure and productivity of his soils and to spread the use of his labor and equipment, a Corn Belt farmer grows other crops with corn—chiefly oats, soybeans, wheat, and hay and pasture crops—in his cropping system. He seldom grows corn on more than half of his cropland. The oat crop is seeded in the spring before work on the corn crop begins and is cut in the summer when cultivation of corn is about over. Soybeans, the second most profitable crop in the area, are planted after corn and harvested earlier. Winter wheat is seeded in the fall when the harvest of other crops is mainly over.

Oats and wheat are the transitional crops in the rotation between corn or soybeans and the grass or legume soil-building crops that are essential to a program of soil maintenance and improvement. Oats and the forage crop are planted together. As the oat plant

is taller and matures more quickly than grasses and legumes, the oats can be harvested without much damage to the other crop. A primary function of the oats is to serve as a companion crop to the forage crop, shading out weeds and providing some protection from wind and sun while the young forage plants become established.

Thus the feed crops—corn, oats, and hay and pasture—and soybeans form the chief basis of the farming system in practically all parts of the region, not only in respect to the cropping program but also in selecting livestock enterprises to utilize the feed crops. The dominant crop, corn, which is primarily a meatmaking feed, is used chiefly for fattening hogs and beef cattle. About two-thirds of all the hogs and one-fourth of all the cattle and calves in the United States in 1954 were on farms in the Corn Belt.

Chickens are a minor enterprise, but farm flocks are kept on many of the farms. Between a fourth and a third of the poultry in the United States is in the Corn Belt. About half of the sheep and lambs "on feed" are fattened in the Corn Belt. Sheep are kept on a few farms.

The dominance of the corn crop and meat-animal production is more pronounced in the central part of the region. Even so, differences in topography and soils within the central section are chiefly responsible for three characteristic types of farming in the central part of the Corn Belt—cash corn, oats, and soybeans; hogs and cattle fattening; and hogs and cattle raising. Other types are dominant in the border areas.

CORN, OATS, AND SOYBEANS are grown for sale on large farms in east-central Illinois and central Iowa. The level land has not been subject to serious damage from erosion even though it has been heavily cropped. Some farmers replenish nitrogen and organic matter in the soil by growing corn and an oats-clover combination in alternate years. In the fall the clover

is plowed under as a green manure.

The cropping systems in the area generally produce a large supply of concentrated feeds, but not enough hay and pasture for a beef-cattle enterprise. Hog enterprises also are smaller than in other parts of the Corn Belt, because farmers believe they cannot afford to take the time from production of crops that would be needed to handle efficiently a larger hog enterprise.

Moreover, conditions that are favorable to a grain type of farming also are favorable to tenant operation of the land. Landlords usually prefer to receive a share of the crop as payment for use of the land. They also often prefer to seal for a Government loan or to sell their share for cash soon after harvest. Thus they frequently are not interested in providing buildings and fences; and, as their tenure is often uncertain, tenants cannot afford to put much money in the fences and equipment that are needed in livestock production. All these conditions are unfavorable to development of a livestock system of farming, even though the cropping system is built mainly around feed grains.

Cash-grain farms are the largest farms in the Corn Belt in both acres of land and total investment but the smallest in hours of labor used. The investment in 1954-1956 on a farm of 230 acres was 88,530 dollars. Crops were harvested from more than 80 percent of the land. The rotation of crops was usually corn, corn, oats, and soybeans, plus about 16 acres of hay. With this cropping system there is produced a large volume of concentrated feeds in proportion to forage from hay and pasture.

Hogs consequently are the most important livestock enterprise. The hog enterprise consists of about 35 hogs marketed annually. By feeding corn to hogs, farmers do a larger volume of business with only a limited addition to their investment in fixed resources. Thus hog feeding is a method of utilizing more fully the

farm operator's labor and thereby increasing his annual income.

The cattle enterprise, as on about two-thirds of the cash-grain farms, is a combination of beef-cattle production and milk production. The herds are predominantly of the beef breeds. About half of the farmers who keep beef-breeding herds fatten a part or all of the cattle raised on the farm. The breeding herd of cows averages about seven head.

The net farm income on typical cash-grain farms from 1954 to 1956 averaged 8,220 dollars, which was somewhat higher than on hog-beef fattening farms. The relationship was reversed in 1947-1949, when prices for livestock were higher relative to prices for grain and soybeans.

HOGS AND BEEF CATTLE are the chief livestock enterprises on the areas of loessal—or windblown—soil, which border parts of the Missouri and Mississippi Rivers and usually are rolling.

A relatively high percentage of the land therefore can be used only for permanent pasture. The cropland is rich enough to produce good yields of corn, but it requires careful management—relatively large acreages of grasses and legumes to give protective cover and maintain organic matter—because of its slope and susceptibility to erosion. A common cropping system consists of two fields of corn, one field of oats, and one field of hay and rotation pasture.

The cropping systems include large proportions of corn to small grains and large proportions of high-quality hay to pasture. Both of these relationships are favorable to meat-producing livestock enterprises. Few farmers sell grain. In fact, in the most highly specialized livestock counties of the areas, some farmers regularly buy a considerable quantity of corn, notwithstanding the high production on their own farms.

Because hogs convert concentrated feeds efficiently into meat, they have first call on the corn grown. But even

with an optimum-sized hog enterprise, many farms in these areas have a surplus of corn. The abundant hay and pasture are utilized better when fed to cattle in conjunction with a concentrate ration. Beef cattle usually are selected in preference to dairy cattle, because fattening cattle use more grain in proportion to forage than do dairy cattle.

Fattening cattle on grain reaches its maximum development in the United States in feedlots on farms in these areas. Most of the feeder cattle are born on western ranges in the spring. Some of them are shipped to the Corn Belt in the fall as feeder calves weighing 350 to 450 pounds. Others are carried on the range over winter, are grazed the following summer, and move to Corn Belt feedlots as 600- to 700-pound yearlings. The heaviest movement of feeders usually is in October. The yearlings are fed to various weights and grades before they are sold for slaughter. Many are marketed in late spring and early summer. The largest volume usually comes in June. Calves, which fatten more slowly than yearlings, are marketed mainly in August and September. Thus the cattle-feeding operation has a production and investment period that may range from 3 to 12 months; 6 to 8 months is the commonest length of time.

Records from a sampling of farms indicate that about half of the farmers in these areas fatten cattle for market. About 10 percent of the cattle feeders fed lots of four carloads or more, and about 50 percent fed from one to three carloads. The rest fed less than a carload and confined their feeding operations largely to cattle of their own raising. Most farmers in the areas keep a small beef-cattle breeding herd. Those who do not fatten large lots of cattle concentrate more on breeding herds.

The typical hog-beef fattening farms may comprise 200 acres, of which 140 acres is harvested cropland. The investment was about 59,440 dollars in

1954-1956. About half of the cropland is used each year to produce corn. The other half is divided between oats and hay in a ratio of about 7 to 5.

The typical cattle enterprise consists of about two carloads of cattle fattened for market and a small breeding herd. The hog enterprise consists of about 150 hogs marketed annually, which requires farrowing about 30 litters of pigs. The ratio of spring to fall litters is about 2 to 1. The breeding herd of cows averages about six.

The net farm income on typical hog-beef fattening farms was about 6,720 dollars in 1954-1956.

Hogs and cattle predominate on the southern side of the Corn Belt—in southern Iowa, northeastern Missouri, and the adjacent counties in Illinois—where the land is rolling and there is more hay and pasture and a smaller supply of feed grains. More than a third of the land is in pasture. The smaller supply of feed grains is due to the scarcity of good cropland and the low yields on the land used for crops—conditions that favor a beef-cattle enterprise in which more emphasis is placed on grazing and less on fattening for market. The same conditions limit the production of hogs.

Typical farms in this area are about 220 acres. They had a total investment of 35,150 dollars in 1954-1956. The value of land and buildings here is about 100 dollars an acre. (It is more than 200 dollars an acre in the hog-beef fattening areas.) Less than half of the land is used for crops. The combination of crops is approximately a 3-year rotation of corn, oats and soybeans, and hay. The typical beef-cow herd includes 20 cows. The hog enterprise is about half as large as on typical hog-beef fattening farms. Net farm income in 1954-1956 was less than half as large as on the hog-beef fattening farms (3,040 dollars, compared with 6,720 dollars).

SEVERAL BORDER AREAS differ with respect to use of land and livestock enterprises.

Farms in the eastern part of the Corn Belt are smaller. The soils are lighter and better drained. Conditions favor production of soft winter wheat. Wheat is the dominant small grain in the crop rotation. Production of corn is no larger than is needed for the hog enterprise. Income from farming thus comes primarily from the sale of wheat and hogs.

On the northern side of the Corn Belt, in northeastern Iowa and northwestern Illinois, the glacial-drift soils are a much older formation than in either the Wisconsin drift or the loess soil areas in Iowa and Illinois. They are more leached and more acid and have lower inherent productivity than the soils of the newer formation.

A larger percentage of the farm usually is in hay and pasture than in other crops. The acreages of corn and oats are about the same. This use of the land results in a large amount of forage in proportion to concentrated feeds. Thus when farmers have set aside a supply of grain for hogs, the amount left bears a wide ratio to the supply of roughage and pasture.

Because the hog ration is mainly corn and production of oats is high in this area in relation to corn, the ratio of fattening grains to protein grains in the remaining supply of feed grains is favorable to dairying rather than to beef cattle. Also favoring dairying are the quality and carrying capacity of pastures. Pastures withstand the hot, dry period of late summer better in this area than in any other part of the region. Most of the milk is delivered to local creameries and condenseries.

The farming on the western side of the Corn Belt is a transition between corn and livestock feeding and wheat and range livestock. The acreage of wheat increases relative to both corn and oats. The low productivity of the hay and pastureland, chiefly because of low rainfall, means fewer cattle. The smaller production of corn means fewer hogs. More corn is sold from this part of the region than from the central livestock-feeding areas—partly because

of the uncertainty of rainfall, which increases the variation in crop yields. To avoid the hazard of not enough feed in dry years, farmers tend to understock with livestock. Thus they have a livestock and cash-grain system of farming.

PRODUCTIVITY AND LAND VALUES in different parts of the Corn Belt are measured fairly well by the intensity of corn production because corn so largely dominates the systems of farming.

The intensity of corn production reflects the acre yield, proportion of cropland planted to corn, and the proportion of farmland that is used for crops. The relationship between corn production and land value therefore is closer in the central part of the Corn Belt than in the border areas, where corn has a less dominant position in the rotation.

Land values are highest in east-central Illinois in the central cash-crop area, where the average value of farmland in 1954 was 383 dollars an acre. Values ranged from 150 dollars to more than 300 dollars in the livestock-feeding areas. In areas where hay and pasture occupied more than half of the land, as in the hog-beef raising area in southern Iowa and northern Missouri, values generally ranged below 150 dollars an acre.

WE DIVIDED the Corn Belt into areas having different systems of farming chiefly on the basis of differences in topography and adaptability of the soil to crops. Wide differences in systems of farming on individual farms are due to those factors and others, such as size of farm, tenure, market outlets, control of capital or credit, and operators' preferences and skills. The variation in systems of farming is noticeable particularly in the border areas, where topography is rougher and several soil types are closely interspersed.

But farms also differ in the central Corn Belt as the quality of land, amount of capital available, and the level of management differ.

The need for grass and legume crops in the rotation is greater on low- to medium-quality land than on high-quality land. A limited amount of capital for operating expenses and annual capital investments restricts livestock production and favors a crop rotation that includes a large acreage of corn.

The level of management is reflected in the livestock system more than in the cropping system. Average managers tend to have a diversified livestock system that includes a dairy enterprise. Good managers tend to concentrate more on hogs and cattle fattening.

Superior management also increases efficiency of operation, which is reflected in net returns, particularly when the capital investment is adequate. The range in net return for well-organized, owner-operated, 240-acre Iowa farms at 1957 prices was from about 3,900 dollars with low- to medium-quality land, limited capital, and average level of management to about 17,800 dollars with high-quality land, adequate capital, and superior management.

FROM YEAR TO YEAR, the fixed resources—land, buildings, and to a considerable extent machinery—of each Corn Belt farm can be utilized in many ways. Land and climate give the Corn Belt an advantage over other areas in production of several crops and several classes of livestock. The alternatives are relatively close as far as returns are concerned.

Corn and soybeans are interchangeable in the crop rotation. The typical livestock enterprises—hogs, beef-cattle fattening, and poultry—can be instituted, expanded, contracted, or liquidated in a year or two. And the emphasis of many Corn Belt cow herds can be shifted from "kept for beef" to "kept for milk" at any time by feeding some of the calves and marketing the milk.

Thus the unspecialized character of the fixed resources and the relatively short period of production and investment for livestock give farmers in the

Corn Belt the ability to adjust readily and quickly to changing economic conditions. This is in contrast to the dairy regions, for example, where the specialized nature of capital and the absence of attractive alternatives make adjustment to change in demand slow and difficult.

A farmer in the Corn Belt may choose among his alternatives on the basis of his expectation of future prices. The usual price relationships give corn a profit advantage among Corn Belt crops, and most farmers plant as much corn as is consistent with their ideas of good use of soil and a balanced production.

In the fall when the size and condition of the corn crop can be estimated reasonably closely, the farmers make decisions about marketing the crop. These are foregone decisions for some farmers; they regularly plan to feed most of their corn to livestock, and their feeding programs vary little from year to year. But others adapt their corn-marketing plans to their expectations of future prices for corn, hogs, and cattle.

A farmer who expects the price of corn to be high compared with the price of livestock may curtail his livestock enterprises considerably and sell part or all of his corn. If he expects the prices of both corn and livestock to be relatively low, he may store his corn and take a price-support loan from the Government. But a farmer who expects the price of hogs to be high relative to the price of corn may decide to expand his production of hogs. He may expand his cattle-feeding program if he believes that prices of fat cattle will be high compared with the current prices for feeder cattle and corn.

The adaptability of agriculture in the Corn Belt is partly responsible for the phenomenon of the hog and cattle cycles. It also accounts for the relatively short duration of these cycles in production.

GREAT CHANGES have been made in farming in the Corn Belt. Energetic

and resourceful operators have adopted new technology and improved production practices—hybrid seed corn, more fertilizer, and legumes and grass-legume mixtures in place of grasses on many acres of hay and pasture and soybeans, which were unknown to Corn Belt farmers not many years ago and now rank high in value per acre and acreage.

Formula feeds and associated additives are increasing the level of feed conversion by livestock. They also represent a transfer from the farm to industry of an important part of the work and the source of knowledge in the compounding and preparation of livestock rations. The benefits of scientific skill in formulation of rations thus become more widely available to livestock producers. Antibiotics were included in 1958 in about 90 percent of commercially mixed poultry starter, grower, and broiler feeds; about half of the poultry layer and breeder feeds; about three-fourths of pig and hog formula feeds; and about 5 percent of dairy and beef formula feeds. Antibiotics reduce death losses and increase output per unit of feed; adding them to creep-feeding rations for pigs may increase pig weights by 5 to 10 pounds at 8 weeks of age.

THE ADVANCE IN TECHNOLOGY has been accompanied by a mounting investment in modern machinery, equipment, and buildings, and by greater expenditures for fertilizers, feed, seed, and the many chemical and biological products used to promote the health and growth of plants and animals and to control the insects and diseases that attack them.

Records from annual samplings of 25 farms in Illinois during the past quarter century reveal that many changes have taken place.

The average size of farms increased 12 percent. The number of men employed (12-month basis) dropped 14 percent. The number of acres worked per man increased 32 percent. Total investment increased 65 percent per

acre and 117 percent per man. Total cash receipts per farm increased 157 percent. Total cash expenses increased 202 percent.

The changes in the use of land included notable increases in acreage of hay, pasture and green manure crops, and soybeans, with corresponding decreases in wheat and barley. The proportion of the land in corn and oats remained about the same.

Crop yields per acre and livestock production per animal increased all along the line. The increase in crop production and livestock production per acre was 26 and 40 percent, respectively. The increase in total crop and livestock production per acre was 32 percent.

Output per man has been pushed up remarkably by farmers' investment in modern equipment and materials for putting advanced technology to work on their farms and by improvement in the managerial skill of farmers themselves. Total crop and livestock production per man increased 73 percent.

A similar story can be told for the whole Corn Belt. Any one of the changes alone may not provide an accurate measure of the change in efficiency of agriculture, but together they indicate the stupendous changes that progressive farmers are making in farming in the Corn Belt.

THE ADVANTAGE of the Corn Belt in the production of corn and livestock is likely to persist. The acreage of corn has declined since about 1925, but the reduction has been more than offset by increased acre yields.

The future should bring even higher yields that will lower the cost of producing a bushel. Mechanization, hybrid seed, fertilizer, and control of weeds, diseases, and insects will be important in boosting present yields.

New corn hybrids now in commercial production yield about 10 percent more an acre than those widely grown less than 10 years ago. Greatly superior agronomic characters of the new hy-

brids reduce the costs of growing corn. Intensive research in progress shows promise of producing hybrids with greater resistance to corn borers and other pests and diseases. They will be important when diseases and insects strike.

New methods of production are gradually taking corn out of the soil-depleting category. It is likely that increased knowledge of soils and their management may permit continuous cropping of corn on the level, water-permeable soils in parts of the Corn Belt. So it is possible that the march of technology will increase—rather than reduce—the Corn Belt's advantage in the production of corn and livestock.

Livestock production has made significant gains in efficiency in the last two to three decades. Since 1935-1939, output per breeding unit has increased about a third. Forty percent more beef per cow and 20 percent more pork per sow is now being produced. Today's pig crop in the Corn Belt can be produced with about 15 percent fewer sows than in 1935-1939. These gains are primarily because animals have greater production capacity, more and better feeds are available, diseases and insect pests are better controlled, and management all along the line is improved. Master swine producers in Iowa saved three more pigs per sow in 1954 than the average farmer in Iowa did. This achievement is a still higher goal for further improvement through better management practices on farms.

Prospects in the Corn Belt during the next few decades depend on the balance between the expanding total demand of a growing population and the rise in per capita demand for meat and livestock products as against the increasing supply of corn and other feed grains that arises primarily from the advance in technology and the resulting boost in yields per acre. Present indications suggest that larger amounts of meat and other livestock products of high quality will be bought if they can be produced at prices that are attractive to consumers.