Establishing Crop Potentials for Indiana Soil Types

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For about sixty years the soil survey program in the United States has been gathering soil facts. Soils have been classified and mapped according to characteristics which influence the use of the soil for various purposes, chief of which has always been the growing of crop plants. The surveys are available in published form for some 61 Indiana counties¹ and in field sheet form only for soil conservation planning in all or parts of 72 counties.²

Early Yield Potential Studies

Prediction values by actual crop yields or by crop index levels for given soils have been included in soil survey reports for at least the past 25 years. Farm managers, bankers, and professional agriculturists have found these very useful in setting yield goals for given lands. Assessors in some states have used them as a major guide in tax valuation studies.

The yield potentials have been only as reliable as the data gained about the soils during the course of the survey. Crop yields reflect as much the willingness or skill of the operator in applying the many necessary factors of production as they reflect differences in the potential of the soils themselves. So, the possible yield levels have generally been stated at two levels of management: (1) a level attained at the time by a majority of the farmers using these soils and (2) a level attained by the "innovator" or "early adopter" class of farmer who were at the time applying most of the better practices in crop production.

Great Production Increases Realized

In the past 25 years, we have witnessed a revolutionary increase in crop yields. Average soil type yields of 40 bushels of corn have been pushed up to 80 or more. Our better farmers are setting their sights on 150 and 200 bushel field yields. Small field yields of over 200 bushels of corn have been attained by a few good farmers who are blessed with especially favorable or responsive soils. At the same time, soybean and other crop yields have steadily risen. Disease resistance, better tillage and crop culture, improved drainage and moisture management, and increasing use of commercial fertilizers with new varieties which have higher production abilities have all played major parts in this crop yield revolution.

There are many who feel that the yield levels already reached are not yet near the ultimate. Yet they are surely closer to the ultimate on some soils than others. Most farmers now producing at high levels feel that the easiest increases are behind them and probably resulted most from better varieties and greater use of fertilizers. More intelligent use of fertilizers is going to be necessary to maximize production further. But just as importantly other factors will have to be applied in combinations designed to fit given soil conditions. For example, sloping, erosive

^{1.} Of these only 38 can be purchased; the rest may be consulted in libraries. About 39 of those are considered suitable for estimating potential yield levels.

^{2.} Available in Work Unit Offices of S. C. S.

soils must be handled better so as to check the losses of water in rainy periods and prolong the use of soil water in peak use seasons.

On the artificially drained, level and depressed soils, where runoff water adds to that which falls as rain, there are problems of over abundance of water at some seasons and a lack at others. Increasing the soil aeration in the early season by improved tillage and managing the available water wisely will be keys on those soils to the further profitable use of good practices, particularly the use of more fertilizers. Farmers on such good level soils who are far out on the periphery of good management are those who are reaping the rewards of continually increasing crop yields at lower unit costs of production.

If all of Indiana was of such level unerosive soil we would be hard put to make any estimate of attainable future production. However, these nearly level lands are limited in amount to some 12 million acres which is about half of all land in Indiana.^a

It is apparent that all farmers are not managing to reach anywhere near the potential of their soils. For example in the most level central Indiana counties we see cornfield after cornfield making 100 bushels per acre or more at least 4 out of 5 years. In one of these counties there may be 20 to 40 entrants in the Indiana Crop Improvement Association 5-Acre Corn Contest with yields in the 120 to 150 bushel bracket. The tendency is to think that the average county corn yields would approach these figures. But they don't. Corn production figures in six of the most level productive, central Indiana counties ranged from 66 to 81 bushels in 1959 and 1960. Obviously there is many a farmer who does not capitalize fully on his soil resources. To maintain or improve his position in the competitive system, and to make his proper contribution to society's future food needs, he must use his land resources more efficiently.

Recent Yield Potential Study

The Purdue Agronomy Department recently completed a study of crop yield potentials for Indiana's important soils. The National Plant Food Institute will publish and distribute the results to fertilizer dealers, elevators, banks and educational agencies. In compiling this information we studied the records of experimental fields for several Indiana soils used for many years for the common crops. To these limited figures we added the estimates that agronomists and agricultural economists had made for field production of crops on a wider range of soils. Yield tables from the soil survey reports were particularly valuable in setting the relative potential between soils.

Yields were estimated by soils and related to the several soil regions. These are shown on a map published as a wall chart for use by the dealers, bankers and educators. Agronomists further grouped the Indiana soil regions geographically to facilitate easy assembly of 3 check lists covering a north section, a central part and a southern part. Check lists include yields of four crops on all important soils and a list of the production factors needed to assure maximum yield from each soil. These will be take-home items for distribution to all interested farmers. In the check

^{3.} From Soil and Water Conservation Needs Inventory data of Soil Conservation Service, 1961.

lists, we arranged the soils by recognizable characteristics in soil regions. This will help farmers who do not have soil maps to learn soil names and select those soils which they most likely have at home. Table 1 gives crop yield estimates for representative important soils of each Indiana soil region. These are included on the wall charts which can be exhibited in places where farmers gather.

A Look Ahead

Economists make some interesting predictions of trends ahead.⁴ If the yearly change in gross output per unit of gross input reached in the 1950-58 period (about 2.5 percent per year) continues we can look for further surpluses even in 1975. The population appears to be expanding at only 1.8 percent yearly. Since these gains have been made with a fairly constant land supply and a diminishing labor supply, operating capital and current operating expenses have increased greatly. Lower farm prices have encouraged greater efficiency and a quest for lower unit production costs. The substitution of machinery for labor has resulted in a larger farm investment and a resulting competition for extra lands to allow full use of the machinery. If land and labor both decrease further, as predicted, the capital investment must grow to maintain production. This can be considered as technology which acts as a substitute for land and labor resources. Land charges contributed only about 11 percent of the total investment in farm production in 1959.

Land and labor in agriculture will both decrease further. Increased population growth assures that pressure on land will increase. By 1975, estimates are that Indiana will lose about 2.7 percent of its land to urban and other uses which will take it out of agriculture.⁵ This is about 5 percent of land currently in crops. A three percent loss in croplands is expected in the most productive central part of Indiana where urban pressures are greatest. Pasture and range lands will move to croplands. Woodlots will disappear from the more level lands. After these adjustments are made, changes in land use can not be expected to make greater areas of cropland available. Between 1975 and 2000 we will probably lose cropland at an increased rate even if effective zoning and taxing procedures are operating then.

To try to integrate all these changes into an equation which would predict future land needs and estimate probable production would be folly. It could not integrate the contribution to be made by technology which has made possible the gains we have already seen in the 1950-60 decade. A 1952 report to the President by the Water Resources Policy Committee foresaw the need for 100 million extra cropland acres by 1975 to fill expected food needs. Current predictions imply that 1975 production needs can be met with even fewer cropland acres than were used in 1952.

However, we must recognize that further food increases must come from a diminishing land resource. Also that production boosting practices

^{4.} Vernon W. Ruttan, Technological Change and Resource Utilization in American Agriculture. A paper presented at the 1961 annual meeting of Indiana Academy of Science at Indiana State College, Terre Haute.

^{5.} Soil and Water Conservation Needs Inventory data of Soil Conservation Service. 1961.

		Soil Description	You	can build these aver	up to age vie	at least lds¹
Soil Region	Soil Name	Soil color, topography, texture and natural internal drainage	Corn	Soybeans	Wheat	Adapted Hay
A	Maumee	Very dark gray, flat sandy loams and loamy sands; poorly drained	90	35	35	3.5
	Door ²	Dark brown, level to sloping prairie sandy loams to silt loams—well drained	75	35	45	3.5
	Plainfield	Light brown, level to duney sands & loamy sands, droughty	35	20	25	2.5
В	Rensselaer (west)	Very dark gray level silty clay loams; poorly drained	105	40	35	4.0
В	Hoytville (east)	Same	95	36	35	8.5
С	Chalmers	Same	115	42	42	4.0
	Parr ²	Dark brown, sloping to level prairie silt loams; well drained	90	40	45	4.0
D E	Brookston	Very dark gray, flat clay loams; poorly drained	105	40	35	4.0
	Crosby^2	Gray, nearly level silt loams; imperfectly drained	90	34	40	3.5
	Miami ²	Brownish, sloping to rolling loams and silt loams, well drained	80	36	45	3.5
	Fox, Kame phase	Brownish, sloping to rolling sandy loams; well drained	55	26	40	3.0
F	Pewamo	Very dark gray level silty clay loams; poorly drained	95	36	35	3.5
	Blount	Gray, nearly level silt loams imperfectly drained	90	34	35	3.5
	Morley	Brown, sloping silt loams, well drained	75	34	40	3.0
G	Brookston	Very dark gray, level silty clay loams; poorly drained	105	40	35	4.0
	Fincastle	Gray, nearly level silt loams: imperfectly drained	90	34	40	3.5
	Russell	Brown, sloping to rolling silt loams; well drained	80	36	45	3.5
H North	Genesee	Bottom lands, graying brown silt loams, clay loams & sandy loams, well drained	100	40	40	
& Central	Fox-Warsaw ²	Brown, level to sloping silt loams & sandy loams, well drained to droughty	70	30	40	3.5
H South	Huntington	Bottomlands; grayish brown silt loams; clay loams & sandy loams; well drained	110	44	40	
	Wheeling ²	Brown, nearly level silt loams: well drained	85	38	40	3.5
I	Vigo	Light gray silt loams of nearly level divides; clay pan; imperfectly drained	90	28	45	2.5

Table 1. Crop yield estimates of important soils in each Indiana Soil Region.

		Soil Description	You	You can build up to at least these average yields ¹		
Soil Region	Soil Name	Soil color, topography, texture and natural internal drainage	Corn	Soybeans	Wheat	Adapted Hay
J	Clermont	Light gray flat silt loams; cemented pan; poorly drained	100	28	45	2.5
	Cincinnati	Brownish, sloping silt loams, well drained	75	30	40	3.0
K	Switzerland	Brown, sloping silt loams; well drained	75	30	40	3.0
L	Tilsit	Brown, nearly level silt loams, cemented pan; mod. well drained	70	26	30	2.5
	Zanesville	Brown sloping to rolling silt loams; cemented pan; well drained	60	26	30	2.5
М	Bewleyville	Brown, undulating to sloping red clay subsoil; well drained	90	35	35	3.0
	Bedford	Brown, nearly level silt loams; reddish subsoil; mod. well drained	80	30	35	2.5
N	Montgomery	Dark gray level silty clay loams; poorly drained	110	50	40	3.0
0	Princeton ²	Brown sloping silt loams & sandy loams; well drained	90	30	40	3.0
	Bloomfield	Light brown wavy to duney loamy sands; droughty	45	24	25	2.5
Р	Iva	Light gray silt loams of nearly level divides; imperfectly drained	105	35	45	3.0
Р	Alford	Brown, sloping silt loams; well drained	100	35	45	3.5

1. Farmers using well recognized superior management practices over a period of years may well exceed these averages 2 out of 4 years. Yields are for nearly level, mostly uneroded areas. For other conditions adjust yields as below:

(1) For slopes up to 6% gradient which are severely eroded decrease yields 15-20%.

(2) For slopes over 6% gradient essentially uneroded decrease yields about 20%.

(3) For slopes over 6% gradient which are severely eroded decrease yields 30-40%.

2. For sandy loam types of these soil series decrease potential yields 20-30%.

3. Genesee and Huntington soils are not commonly used for hay.

like irrigation are useful only where water is available and this means largely underground sources. Only the droughty soils will benefit enough from supplemental water in a climate like Indiana's to make irrigation pay.

Six central Indiana counties mentioned before with corn yields ranging from 66 to 81 bushels, have cropland soils largely of level Crosby and Brookston types. These two soils can be built up to produce an average corn yield of at least 90 and 105 bushels respectively. Sloping soils could be expected to yield at about the county average levels or around 75 bushels. A 25 percent increase in corn yield could be expected in these counties very soon from applying only the presently known management techniques in growing our present corn hybrids.

Farmers who have made notable strides in fertility and other cultural management have pointed the way to eventual yields well above the estimates for Brookston and Crosby. By concentrating the grain crops on such productive soils the present crop production could be maintained on one-quarter to one-third less acres. By releasing sloping, eroded and less productive lands to use for pasture we could provide more and better low cost feeds for our livestock industry. This would protect the soils for later more intensive use to feed the expanding population a generation or two hence. Also, by reducing floods and erosion which affect the use of croplands and also the general welfare, these poorer lands will assume even greater usefulness.

All in all the food producing potential for a generation ahead in Indiana looks adequate. We have time to sharpen our technology further. To do so, continuing agricultural research is absolutely essential even in this period of plenty.

Agronomists hope that the recognition of their potential yields will help stimulate farmers who have not reached this potential to aim higher. Higher production means lower unit costs and increased efficiency, a goal of all far-looking farmers.

Some Values of the Production Potentials

- 1. Learning crop yield levels to fertilize and manage for. Use of more nitrogen than for the expected yield is wasteful. Where the potential yield is likely to be only 80 bushels of corn it adds to the unit production cost to use enough to raise 100 bushels or more.
- 2. Studying alternative uses of land and probable earning capacity in direct family help Extension programs like Better Farming-Better Living. These yield levels are a basis for economic analysis of crop and pasture systems adapted to different enterprises in the several soil situations in Indiana.
- 3. Projecting the long time food needs of our growing population and determining how these may be met with the fixed amount of land available at given times ahead.
- 4. To help determine the economic impact on communities where farmers set out to achieve higher production in line with their potential yields.
- 5. In comparing actual yields with potential yields some soil areas will be seen to offer much improvement. Their soils will be more responsive to efficient use than other soils which already approach more closely the potential. This will point to areas where Extension management programs may operate more intensively and be especially fruitful.