

HIGHEST PROFIT PLANS FOR BEGINNING FARMERS
ON PEMBROKE, DECATUR, BAXTER, AND DIXON SOILS
IN SOUTHERN CHRISTIAN, TODD, AND LOGAN COUNTIES

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Present farming with high costs relative to product prices places a premium on efficient farm planning. Efficient planning is of particular importance to the beginning farmer. Capital shortages often limit his volume of business. In contrast, the established farmer with more funds often can expand his volume of business and so lower his unit costs of production. This opportunity may not be open to the beginning farmer with limited capital. His opportunities for increasing his income may be limited to more efficient use of his existing resources -- land, labor, machinery, buildings, and other capital. Therefore he must plan carefully to obtain these efficiencies if he is to compete with farmers who have more capital.

This study is designed to outline alternative plans that can be expected to yield more profits from the resources available to beginning farmers. The plan for a particular farm, however, must fit the resources peculiar to that farm, if profits are to be maximized. Even though two farmers may be farming on the same types of soil, their farm plans will differ if they have different quantities of labor, capital, or managerial skill.

This study has been made to help beginning farm families improve their farm planning by outlining plans for beginning farmers with different amounts of land, labor, and capital. While the plans outlined are not likely to fit a particular farm, they can serve as useful guides to beginning farmers with different quantities of resources.

OBJECTIVES OF THE STUDY

The broad objective is to determine farm plans that maximize profits for different farm situations on Pembroke, Decatur, Baxter, and Dickson silt loams of southern Christian, Todd, and Logan counties. The farm plans are made particularly for beginning farmers (or other farmers with similar resources) and for use in the Farm and Home Development program of the Agricultural Extension Service.

The more specific objectives are to (1) determine profit maximizing plans for farmers with different amounts of land, labor, and capital, (2) show how the maximum profit plan for a farm depends on the relative amounts of land, labor, and capital available, and (3) show how maximum profit farm plans differ from plans now in operation and how current plans need to be reorganized to maximize profits.

METHOD OF ANALYSIS AND TECHNIQUES OF LINEAR PROGRAMMING

Every farmer has the opportunity of selecting a production plan from a large number of alternative plans. Crop and livestock enterprises along with the land, labor, capital, and management used in production can be combined in thousands of different ways. Consider a farmer who has \$3,000 to use for wheat and/or hay. Let's say he can use this money to grow 10 different kinds of hay and 6 different kinds of wheat, that he can buy 6 different kinds of fertilizer which he can apply at 5 different levels, and that he has 2 methods (irrigation or dry-farming) which he can use in growing the crops. Already this gives him 3,600 different ways of using his \$3,000 ($10 \times 6 \times 6 \times 5 \times 2 = 3,600$). Now if we add the thousands of ways in which he can use 52 weeks of labor and 200 acres of land for these and other crops along with livestock, the number of alternative plans becomes almost countless. In actuality, of course, no one considers these thousands of different alternatives when deciding on a particular farm plan. However every farmer knows that he has the opportunity of producing many different combinations of crops and livestock, and he has the opportunity of producing these in many different ways. Moreover, if a farmer wants to get highest profits, he must choose the plan that will accomplish this, considering the amounts of land, labor, management, equipment, buildings and other capital items available to him.

A procedure or method of analysis which allows consideration of the many alternatives open to a farmer is the technique of linear programming. By using this technique, the plan which yields highest profits can be determined, given the resource limitations of a particular farm situation, the prices, and the production from a given input.

Neither time nor funds permit plans to be worked out for a large number of individual farms. Yet, since the amounts of land, labor, and capital vary from farm to farm and since the most profitable plan differs with the amounts of these resources available, it was necessary to work out plans for a number of different farm situations; in this way, farmers with different amounts of resources can use these plans as guides for deciding on their own plans. First interviews were obtained with 82 farmers who were or who recently had been in the Institutional-On-Farm-Training Program for veterans. From these interviews information was obtained on acres, crop and livestock organization and production, sales and income, labor supply, and production expenses. These farms were grouped according to total acres of crop land. On this basis, 19 farms had between 51 and 100 acres, 28 had between 101 and 200 acres and 18 had between 201 and 400 acres. From each of these groups subgroups of farms that were highly similar with respect to size of tobacco allotment, labor supply, and capital for production expenses were selected. With the use of linear programming the most profitable farm plan was then developed for the farm situations represented by these subgroups.

FARM SITUATIONS STUDIED AND RESOURCE RESTRICTIONS

The farm situations studied can best be described by outlining the amounts of cropland, labor, and capital for production expenses available in each of the situations. The amounts of resources listed are those left after subtracting the

resources required for tobacco production. It was assumed that tobacco would be produced up to the full amount of the allotment. Hence, tobacco production was forced into the production plan. The income from the optimum plan thus includes income above variable costs from the tobacco allotment plus income above variable costs from the remaining resources.

Labor supply per mature worker was estimated on the basis of 10 hours per day, 26 days per month or 260 hours per month. It includes operator and family labor, as well as full-time hired labor and regularly hired labor during rush seasons. Occasional hired labor, on the other hand, was included as a variable cost. The supply of capital for variable expenses represents the total amount used for variable costs in 1955 by the selected farms.

The resource supplies (after tobacco) for the small, medium, and large-sized farms are as follows:

Kind of resource	Resources available after tobacco for		
	Small-sized farms	Medium-sized farms	Large-sized farms
Cropland, (acres)	80	134	312
Labor, (hrs.)	2,088	2,612	3,800
January	65	156	34
February	156	216	254
March	240	282	504
April	267	281	496
May	200	221	364
June	225	269	358
July	176	236	242
August	144	197	196
September	140	166	249
October	211	259	442
November	176	216	395
December	88	113	266
Capital for variables expenses (\$)	2,129	3,294	6,700
Tobacco allotment (acres)	3.3	3.0	6.3

The purpose of this study is to find whether these farms could reorganize their present resources so as to earn more income above variable costs than they received in 1955 and to find whether they could further increase their income above

variable expenses by using more capital along with their present supplies of land, labor, buildings, and equipment. Hence, the highest profit plans were determined for each of the three different sized farms with capital for variable expenses doubled.

Incomes ~~above~~ variable expenses from present plans are based on 1955 prices for farm products produced and for items such as fertilizer, seed, and feed used in production on these farms. In the highest profit plans for these farms, 1955 levels were used to represent the expected levels for variable expenses or costs in the immediate years ahead. The product prices expected in the immediate years ahead and used to compute the highest profit plans are listed below.

Product	Price (\$)
Corn-selling (bu.)	1.25
Corn-buying (bu.)	1.35
Barrows and gilts (cwt.)	16.25
Sows (cwt.)	13.95
Choice steers (cwt.)	23.21
Prime steers (cwt.)	25.41
Good steers (cwt.)	20.42
Commercial cows (cwt.)	13.50
Milk, Grade A (cwt.)	4.10
Milk, Ungraded (cwt.)	2.60
Hay-selling (ton)	21.50
Hay-buying (ton)	25.00
Eggs (doz.)	.30
Chickens, young (lb.)	.22
Chickens, old (lb.)	.14
Milk, home used (qt.)	.08

In setting these prices, we were more concerned with the relationships between prices than the actual level of prices. Relative prices are most important in determining the combination of enterprises that yield highest income. The absolute level of prices influences the level of income but not the best use of resources.

To determine the combination of enterprises that can be expected to yield highest income above variable expenses it was necessary to allow choice among many different enterprises or activities which at the same time were suitable to the southern Christian, Todd, and Logan county farming area.

ENTERPRISES USED IN PROGRAMMING AND PRODUCTION REQUIREMENTS

Factors that determine whether an enterprise is adapted to a particular area are soils, topography, climate, markets, and the skills of farmers as well as their personal likes and dislikes, acres of land, quantity and quality of labor, and other resources.

Each of the enterprises discussed below was considered adaptable to the area and hence might enter into the most profitable program on many of the farms. However, only a few of them might be appropriate for any individual farm.

Two basic crop rotations were considered. The first was a two-year rotation with grain as the only output. A field in this rotation would be in corn the first year. After the corn picking the field would be seeded to barley, which would be harvested in middle or late June of the following year. The field then would be plowed immediately and planted to grain sorghum to be harvested in October. Thus, every two years this rotation would produce three grain crops. A high output per acre is its main advantage. Moreover, an entire farm in this rotation requires no forage harvesting machinery, making possible more highly specialized and lower cost mechanization in grain production.

This rotation also has disadvantages. Its intensity may cause difficulty in maintaining soil conditions favorable to high crop yields over a long period of years. In addition, timing problems are encountered in sandwiching barley between corn and grain sorghum. Even with early maturing varieties of corn, some years a late corn crop would make seeding of barley a risky venture. Also, in some years harvesting barley in time to plant sorghum early enough to assure its maturing in the fall may prove difficult. Moreover, sorghum is a relatively difficult crop to store due to the amount of moisture it draws from the air. These considerations suggest that a grain drier may be highly profitable when a considerable acreage is planted to this rotation. A drier permits an earlier corn harvest and hence an earlier seeding of barley. In addition, it minimizes the risk involved in storing grain sorghum as well as corn.

The second rotation considered is a four-year rotation of both grain and forage. A field in this rotation would be in corn the first year and in barley the second. After barley the field would be in either hay or pasture for the remaining years in the rotation. In this analysis the fields were assumed to be alternated between hay and pasture. However, a farmer could vary this procedure if it did not produce the combination of hay and pasture suited to his livestock program.

Other crop enterprises considered were permanent pasture and corn for silage.

The livestock enterprises considered were a dairy enterprise, a sheep enterprise, and several variations of both the hog and beef enterprises. The dairy enterprise was assumed to be producing for the Grade A market. The cows were assumed capable of producing 7,000 pounds of 4 percent milk per year. Labor requirements reflect use of a walk-through milking parlor. In addition to milk, the average output from this enterprise was figured at 220 pounds of cull cow and 50 pounds of veal calf.

The sheep enterprise considered was the one most typical in Kentucky -- each ewe producing 1.25 lambs to be marketed at 80 pounds in late May or early June. This enterprise requires large amounts of forage relative to grain.

The following three hog enterprises were considered:

Sows - two farrowings: Fall litters were farrowed in July and marketed in January; spring litters were farrowed in January and marketed in July. Annual output per sow was figured at 12.5 hogs at 220 pounds each and 387 pounds of cull sow. Each sow farrowed twice yearly.

Sows - six farrowings: Pigs were farrowed in January, February, April, July, October, and December and hogs were marketed in January, April, June, July, August, and October. Each sow farrowed twice yearly. This enterprise was included because it prevents peak hog labor requirements from coinciding with peak crop labor periods.

Feeder pigs: Feeder pigs were bought in March at 60 pounds and sold in July at 220 pounds. Also feeder pigs were bought in October at 80 pounds and sold in February at 220 pounds.

Seven variations of the beef enterprise were considered. Three of these were cow-calf systems, and four were feeding systems with purchased feeder cattle.

Cow-calf No. 1: Calves were dropped in January, pastured during the summer, put on full feed in dry lot November 1, and sold at about 1,000 pounds, choice to prime in April.

Cow-calf No. 2: Calves were dropped in January, pastured during the summer, roughed through the winter, pastured with grain the next summer, and sold as 1,000-pound choice steers in September.

Cow-calf No. 3: Calves were dropped in February or March, pastured during the summer, roughed through the winter, pastured through the surplus grass season, full-fed for about 120 days, and sold at 1,000 pounds, choice to prime, in October.

Feeder cattle No. 1: Choice calves were bought in September at 350-400 pounds, wintered, pastured through the surplus grass season, pastured with full grain, and sold in late fall at about 950 pounds, choice grade.

Feeder cattle No. 2: Choice calves were bought in early fall at 500 pounds, wintered, pastured through the surplus grass season, full-fed in dry lot, and sold in the fall at 1,050 pounds, choice to prime.

- Feeder cattle No. 3: Choice calves were bought in the fall at 500 pounds, wintered, pastured, full-fed in dry lot beginning August 1, and sold in early fall at 950 pounds, good to choice.
- Feeder cattle No. 4: Choice steers were bought in early fall, wintered, fed grain on grass all summer, and sold in early fall at 1,000 pounds, choice.

These variations permitted the beef enterprise to be adapted to a wide range of resource combinations. For instance, on farms where labor is scarce but funds are ample, one of the feeder cattle enterprises might fit in best. On the other hand, if money is scarce and especially if labor is more plentiful, a cow-calf program may be more appropriate.

To work out more profitable farm programs, the production requirements for each of the above enterprises also had to be determined. These requirements depend to a considerable extent on the level of efficiency which can be attained. A level of efficiency was assumed which is above average but which can be and is regularly attained on many farms. These requirements are presented in Table I.

IMPROVED PLANS

The plans discussed here are the ones producing most income from the prices, yields, resource availabilities, and requirements previously outlined. These incomes are considered attainable and their underlying plans appear workable and practical enough to be put into practice on actual farms. However, these plans can serve only as guides to farmers since no single farm is likely to be exactly similar to the ones studied and future prices may differ from the ones used. They will need to be studied and in most instances modified to fit individual farms.

Plans for Small Farms. The resources on the typical small farm were 83.3 acres of cropland, about 12 months of labor, and \$2,318 for operating expenses. The most profitable plan indicates that this acreage of land is not enough to keep one man busy throughout the year at profitable work. Land and money for operating expenses are the resources which limit size of business so the most profitable plan is the one which makes best use of the land and expense money.

Cash crop farming (based on the 2-year rotation of corn-barley and sorghum along with tobacco from the allotted acreage) returns the most income to the available small-farm resources. A program of this kind is expected to pay all the operating expenses and leave \$8,318 as returns to labor, management, and fixed capital. Of the \$10,634 gross income from this plan, about \$2,732 would come from the tobacco crop and the rest from sales of grain. These grain sales would be equal to 6,321 bushels of corn.

Why is it that a combination of crops and livestock will not earn more income than crops alone under these conditions? It has been pointed out that land and money for expenses are both in relatively short supply so both must be used very intensively. Dairy cows, hogs, or both might be considered since they earn considerable income per acre and per dollar spent.

But dairy cattle require pasture and hay. If some land were used to produce grazing and hay, the grain production would be reduced by such large amounts, that the income from dairying would not restore the income lost from grain sales. In addition, dairy cattle require considerable labor which is also in short supply in some seasons of the year. A sizable investment in cows, buildings, and milk-handling facilities would also be required in addition to the investment in hay-making machinery. If dairying were included, the most profitable cropping system would differ considerably from the preceding plan. It would include 38 acres in the corn, barley, sorghum rotation and 3.3 acres in tobacco. It would include 14 acres in a four-year rotation of corn, barley, and two years of hay and pasture. In addition, 21 acres would be placed in permanent pasture. Eight dairy cows would be kept and about 3,300 bushels of grain would be sold. The returns to labor, management, and fixed capital from this program would be about \$7,100 or about \$1,200 less than under the cash grain program. On the other hand, the income from cash grain, tobacco, and dairying combined would be less likely to vary as much from year to year as would the income from cash grain and tobacco.

If some hogs were kept, some of the expense money would be needed for hog production, and it would be necessary to obtain this money by reducing the acreage of grain. Again, the income from hogs would not be large enough to restore the income lost by reducing grain sales. In this program, the land again would be in the corn-barley-sorghum rotation and tobacco. Six sows would be kept to farrow twice a year, and about 40 feeder pigs would be purchased each year and fed to market weights.

If more than \$2,318 in expense money were available, how could it best be used with the other resources on the small farm? Since all the land was used when only \$2,318 was available in expense money, additional capital would not permit expansion of the cash grain-tobacco program, unless more land was bought. To use the additional money profitably on the same acreage, it would be necessary to change the combination of enterprises.

At least one new enterprise must be adopted. It will be one which yields a high return per acre of land but it will yield a smaller income per dollar of expenses than will the cash grain and tobacco program. Hogs fit into such a situation better than dairy cows since they allow the land to remain in grain production, its most intensive use.

A farm program such as this would yield a gross income of \$14,686. After payment of operating expenses, \$10,168 would remain as returns to labor, management, and fixed capital. As a result of adding \$2,130 expense money and adding the hog enterprise, gross income would be increased by slightly over \$4,000.

The hog enterprise would consist of six sows, each farrowing twice yearly. In addition, about 70 feeder pigs would be bought and fed to market weight along with the home-produced pigs. In this program, slightly over 4,500 bushels of corn would be sold for cash and the remainder fed to hogs.

Production Requirements and Income for All Enterprises Considered

	Hay Buying (per ton)	Hay Selling (per ton)	Grain Buying (per bu.)	Grain Selling (per bu.)	Rot. #1 (per acre)	Rot. #2 (per acre)	Silage corn (per acre)	Pasture (per acre)	Dairy (per cow)	Hogs two-litter (per sow)
Labor (in hours):										
January	0	0	0	0	0	0	0	0	7.99	8.3
February	0	0	0	0	0	0	0	0	7.21	5.6
March	0	0	0	0	0	0	0	.45	6.47	5.0
April	0	0	0	0	.72	.36	1.44	0	5.69	5.0
May	0	0	0	0	.33	.30	1.21	0	5.69	5.0
June	0	0	0	0	1.90	1.18	.74	.47	5.69	5.0
July	0	0	0	0	.37	1.36	0	0	5.69	6.3
August	0	0	0	0	0	.85	10.00	0	5.69	5.6
September	0	0	0	0	0	1.36	5.68	.47	5.72	5.0
October	0	0	0	0	2.28	.68	0	0	6.38	5.0
November	0	0	0	0	0	0	0	0	7.58	5.0
December	0	0	0	0	0	0	0	0	7.99	5.0
Land (acres)	0	0	0	0	1	1	1	1	0	0
Capital (\$)	25.00	0	1.35	0	27.50	14.91	52.85	6.08	92.04	141.67
Pasture, early (acres)	0	0	0	0	0	-.25	0	-1	3.0	.04
Pasture, late (acres)	0	0	0	0	0	-.25	0	-1	3.0	.04
Hay or silage (tons)	-1	1	0	0	0	-1.25	-5.1	0	2.15	0
Grain (bushels)	0	0	-1	1	-81.67	-27.57	0	0	24.2	180.14
Gross income (\$)	0	21.50	0	1.25	0	0	0	0	315.54	516.57
Variable cost (\$)	25.00	0	1.35	0	27.50	14.91	52.85	6.08	92.04	141.67
Income above variable cost (\$)	-25.00	21.50	-1.35	1.25	-27.50	-14.91	-52.85	-6.08	223.50	374.90

TABLE I (Cont'd.)

Production Requirements and Income for All Enterprises Considered

	Hogs Multiple (per sow)	Hogs Feeders (two pigs)	Beef Feeders #1 (per calf)	Beef Feeders #2 (per calf)	Beef Feeders #3 (per calf)	Beef Feeders #4 (per calf)	Beef Herd #1 (per cow)	Beef Herd #2 (per cow)	Beef Herd #3 (per cow)	Sheep (per ewe)
Labor (in hours):										
January	6.3	.38	1.22	1.22	1.22	1.22	5.74	4.99	4.45	1.050
February	6.3	.19	1.10	1.10	1.10	1.10	6.04	4.31	4.31	.900
March	5.0	.16	1.22	1.22	1.22	1.22	6.33	5.63	5.63	.515
April	5.7	.32	.47	.47	.47	.47	4.06	4.81	3.60	.160
May	5.0	.32	.22	.22	.22	.22	1.32	3.24	1.55	.515
June	5.0	.32	.22	1.04	.22	1.86	1.27	3.12	2.30	.145
July	5.7	.16	1.07	1.92	1.92	1.92	1.23	3.15	3.15	.150
August	4.9	0	1.07	1.92	1.92	1.92	1.23	3.15	3.15	.150
September	4.9	0	1.14	1.86	1.23	.93	1.25	2.17	3.10	.145
October	5.7	.19	1.45	1.18	1.18	1.18	1.80	1.69	2.61	.150
November	5.0	.38	1.18	1.18	1.18	1.18	4.21	3.53	3.53	.370
December	6.3	.38	1.22	1.22	1.22	1.22	4.74	4.04	4.04	.750
Land (acres)	0	0	0	0	0	0	0	0	0	0
Capital (\$)	141.67	34.12	72.41	110.84	100.40	194.11	14.79	12.94	13.23	5.710
Pasture, early (acres)	.03	.01	1.24	1.39	1.46	.33	1.75	2.08	2.97	.330
Pasture, late (acres)	.03	0	.33	0	0	.33	1.75	2.08	1.62	.330
Hay or silage (tons)	0	0	.966	1.439	1.263	1.244	2.231	3.100	2.622	.200
Grain (bushels)	180.14	16.5	28.8	29.11	12.95	25.00	35.44	32.17	30.60	1.250
Gross income (\$)	518.05	75.06	224.86	265.44	213.65	243.70	200.44	205.31	221.49	30.20
Variable cost (\$)	141.67	34.12	72.41	110.84	100.40	194.11	14.79	12.94	13.23	5.71

Plans for Medium-Sized Farms. The medium-sized farm used in the analysis had only slightly more labor than the small farm. However, it had 50 acres more cropland and almost twice as much expense money as did the small farm.

Again land and expense money limited the size of business which was possible. Both of these items were used up in the most profitable program. Some labor was unused in each month except for June and October.

The cropping system in the most profitable program consisted of 3 acres of tobacco, 97 acres of the all-grain rotation, and 37 acres of the rotation which includes grain, hay, and pasture. Total feed production consisted of 8,942 bushels of grain (corn equivalent), and 46 tons of hay.

Since expense money was relatively scarce, the livestock program was again eliminated in favor of crops since the expense money can be turned over faster in crop production. Since money was not available with which to operate a livestock program, it was again necessary to sell the feed produced. The total grain production of 8,942 bushels would be sold as would the total production of 46 tons of hay.

Selling large amounts of hay is not generally considered a profitable practice in many or most years. In this case, profits were highest by taking some capital from the all-grain rotation so that all of the land could be used. This resulted in some hay being available which, for lack of money, could not be fed to livestock and so it was sold.

This system would be expected to produce \$11,950 income above variable costs. This would be the return to labor, management, and fixed assets such as real estate and machinery.

There is an alternative program which is better in some respects than the one just discussed. The cropping system would be more balanced. It would include, besides the tobacco, about 40 acres in each of the rotations and 45 acres of permanent pasture. This means that roughly half of the cropland would be in hay and pasture at all times.

The livestock program would consist of 20 beef cows with calves dropped in late winter and 6 sows, each farrowing 2 litters per year. The calves would be pastured the first summer, wintered, pastured again through the surplus grass season, and then placed in dry lot. They would be ready for market in early fall at a weight of about 1,050 pounds and would grade choice to prime. All hogs produced would be fed to market weights of about 225 pounds.

This system would not involve selling hay but would call for sales of 3,200 bushels of corn. Its main disadvantage is that the same resources would yield about \$1,250 less income. Its main advantages are that erosion could be controlled more easily and it might yield a steadier income than the maximum income program.

If twice as much capital were available for operating expenses, the most profitable program would be quite different. Livestock would play a much more important part, and the cropping system would be much less intensive than that of the highest income plan with less capital.

Tobacco would remain in the program at the maximum level permitted by the control program. Other crops would include 55 acres in the all-grain rotation, 40 acres in the grain-forage rotation, and 40 acres in permanent pasture.

The livestock program would include 40 head of feeder cattle and 10 sows, each farrowing two litters per year. However, since expense money still imposes a limit on size of business, all the feed produced could not be fed and 3,700 bushels of corn and 11 tons of surplus hay would be for sale.

In the low capital situation on this farm, only land and operating capital were completely utilized in the most profitable program. It is likely that if slightly less capital had been available some land would have gone unused. In addition, the need to use the money intensively placed a heavy burden on the land, requiring most of the acres to be cropped heavily. In such a system the labor supply was not at all well utilized and would have been used even less efficiently except for the tobacco. The additional capital was not only productive itself but it also allowed the land to be used less intensively with reduced erosion hazards and fertility and soil structure problems. Probably more important is the fact that it allowed the available labor to be much more fully employed.

As a result of the additional capital, gross income increased by \$6,100 over the highest profit plan with less capital. More capital would be profitable as is indicated by the fact that if one dollar less had been available, gross income would have decreased by 1.69 dollars. However, there is no indication as to how much more money could be used at this highly profitable rate.

If one less acre of land had been available, gross income would have decreased by \$40.

Plans for Large Farms. The large farm used in the analysis had 312 acres of cropland. To be applied to the land were a labor force of two men and \$7,000 in operating money. Thus, each man had 156 acres and \$3,500 with which to work compared with 71 acres and \$2,000 on the small farm, and 100 acres and \$2,592 on the medium-sized farm.

The situation has changed from one in which labor did not have enough other resources to work with to one in which the other resources do not have enough labor to work with, at least in some seasons. However, the capital per acre of land is less on the large farm than the two smaller ones.

The most profitable cropping program is more diversified than those for the smaller farms and this is mainly due to a shortage of labor in the month of June and also of capital for operating expenses. The crops consist of 6.3 acres in tobacco, 105 acres in the all-grain rotation, and 129 acres in the grain-forage rotation. Seventy-eight acres, all the remaining cropland, would not be used.

The livestock program consists of 26 head of choice calves, bought in September at 350-400 pounds, wintered, pastured through the surplus grass season, pastured with full grain, and sold in late fall at about 950 pounds and of choice grade. These use only a small part of the feed produced leaving 12,000 bushels of grain for sale as well as 135 tons of hay. This plan yields \$21,758 in income above operating expenses.

The explanation for this plan appears to lie in the scarcity of June labor and the resulting necessity for using it very efficiently. The grain-forage rotation only requires about two-thirds as much June labor per acre as does the all-grain rotation. Moreover, the feeder cattle system in the plan demands very little June labor, requiring only about one-fifth hour per head. This seems to explain why this enterprise is in the program. The cattle require pasture and hay, and these feeds are produced by the grain-forage rotation which also produces considerable hay in excess of that required by the cattle.

The \$7,000 in expense money was about all that could be profitably used in this situation. When another \$7,000 was made available the most profitable program was not changed significantly.

SUMMARY AND CONCLUSIONS

Land and cash for operating expenses were the most limiting resources on the small and medium-sized farms. Hence, when these farms were planned with existing resources, profits were larger from plans that use land intensively and yield a high, quick turn-over on operating capital. The small farms made most income from a system of cash grain (corn, barley, and sorghum) and tobacco farming. On the medium-sized farms, livestock entered into the most profitable plan in a very small way; most of the income on these farms again came from sale of cash crops -- corn, barley, sorghum, hay, and tobacco. On the large farms, however, labor was the most limiting resource. Thus, the profit-maximizing plan for these farms was one that yielded a high return to labor. This plan consists of 105 acres in the corn-barley-sorghum rotation, 129 acres in the corn-barley-hay-pasture rotation and 26 feeder cattle. Both the four-year rotation and feeder cattle yield high returns to labor. For highest profits, this study suggests that land, labor, and capital need to be used in different ways as the quantities of these resources vary from farm to farm. As land and working capital increased and labor became relatively scarce, the cropping system became less and less intensive and livestock became more significant in the total program.

When operating capital was doubled (land and labor remaining unchanged) above existing levels, livestock's high return to land and labor became a significant part of the program on small and medium-sized farms. On the small farms, highest profits came from the production of tobacco, corn, barley, and grain sorghum and from the production of pork from 6 sows and 70 feeder pigs. The highest profit plan on the medium-sized farms included 40 feeder cattle, 10 sows each with 2 litters, 3 acres of tobacco, 55 acres in the corn-barley-sorghum rotation, and 40

acres in the corn-barley-hay-pasture rotation, and 40 acres of permanent pasture. On both the small and medium-sized farms, the livestock programs were of insufficient size to consume all the grain that was produced, and some hay was sold off the medium-sized farms. When operating capital was increased on these farms, labor and land became more limiting relative to operating capital. Labor became more limiting on the medium-sized than on the small farms. Thus, the four year rotation and permanent pasture entered into the plan since they place relatively low demands on labor. An increase of operating capital on the large farms did not alter the highest income plan significantly. These farms already had as much operating capital as could be used profitably with the existing labor and land.

It should be emphasized that, over a long period of years, it may not be desirable to use land as intensively as is done by the two-year, all grain rotation or to sell such large amounts of feed as are specified in the farm plans discussed. However, a beginning farmer who is short on capital may find some system such as these useful as a means of increasing income in the short run so that additional capital may be accumulated for investment.

Plans now in operation on these farms were less intensive in use of land and more diversified than the highest profit plans. Plans now in use, regardless of farm size, included both grain and forage production with considerably more emphasis on forage than in the profit-maximizing plans. Plans in operation, irrespective of farm size, gave more emphasis to livestock (usually some combination of various livestock) than did the highest profit plans. Plans now in operation on the farms studied appeared to be yielding from \$2,000 to \$15,000 less income above operating expenses than the highest profit plans. These figures suggest real opportunity for improvement in incomes on many farms either through recombination of enterprises or a more efficient transformation of inputs into product or through both.