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DRY EDIBLE BEAN PRODUCTION PRACTICES AND COSTS RED RIVER VALLEY, NORTH DAKOTA

by
Roger G. Johnson
and
Etaferahu Takele

Department of Agricultural Economics
Agricultural Experiment Station
North Dakota State University
Fargo, North Dakota

FOREWORD

The authors wish to thank the Red River Edible Bean Growers Association in providing a sample listing of producers. Special appreciation is extended to the producers who provided information about their costs and production practices. The authors also acknowledge the help of Connie Nelson in collecting the data.

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Highlights

The objective of this study is to provide information on production practices, costs and returns of dry edible bean production in North Dakota in 1979. Data were obtained in July 1979 from personal interviews with 80 producers in the Red River Valley, the major dry edible bean producing area in North Dakota. Pinto bean was the major bean class produced. Fifty-nine producers had pinto beans, 15 grew navy beans and six producers had both types. Dry edible beans averaged 14 percent of producers' crop acreage. The land was 59 percent owned with the remainder equally divided between share and cash rental.

Most of the machinery requirements for dry edible bean production are the same as other crops except the additional specialized pinto bean harvesting implements. Several tillage operations are used for seedbed preparation and to control weeds. Nearly all producers applied herbicides to control weeds.

The total costs of production excluding a management charge averaged $159.30 per acre. Producers with large farms had slightly lower machinery costs per acre than smaller producers. The average cost of production of navy beans was higher, $164.75 per acre, than pinto beans, $157.47 per acre. The major reasons for the difference was more fertilization and insurance for navy beans. At the average price received in 1979, $.194 per pound, dry edible bean production resulted in a positive return to risk and management of $131.12 per acre.

ECONOMICS OF DRY EDIBLE BEAN PRODUCTION IN THE RED RIVER VALLEY OF NORTH DAKOTA, 1979

by

Roger G. Johnson and Etaferahu Takele*

Farmers have been making changes in their farming operation to adjust to changing economic conditions and to the development of new crops in the area. The most significant change in the Red River Valley has been the adoption of additional row crops, including dry edible beans. Acreage of dry edible beans in North Dakota increased from 27,000 in 1965 to 240,000 in 1980 (1). The historical change in acreage is given in Figure 1.

Dry edible beans are human food with a protein content of 22 to 23 percent (2). The protein quality, however, is lower than that of milk, meat, or eggs, because it lacks certain amino acids which are essential for proper body utilization. Dry edible beans also contain phosphorous, iron, and vitamin B_1, and are low in fat. Because they are the least expensive source of protein, dry edible beans are an important staple for low income groups in many less developed countries. The dry edible bean crop in the United States is partly exported, but mainly consumed by low income rural nonfarm households of the South.

The United States produces more than 14 different types of dry edible beans, but nearly 60 percent of the production is accounted for by pinto and navy beans (3). North Dakota's dry edible bean production is mainly pinto beans (about 86 percent) and some navy beans (about 13 percent). Other kinds of dry edible beans are currently being tested for the area. The Red River Valley is the major dry edible bean producing area in North Dakota, accounting for about 80 percent of the state's production.

The introduction of dry edible beans in North Dakota has been recent compared to other crops, particularly small grains. Information pertaining to the production practices and costs has been limited. The main objective of this study is to provide such information to help farmers make decisions regarding entering or expanding production.

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*Dr. Johnson is a professor and Takele is a former graduate assistant, Department of Agricultural Economics.

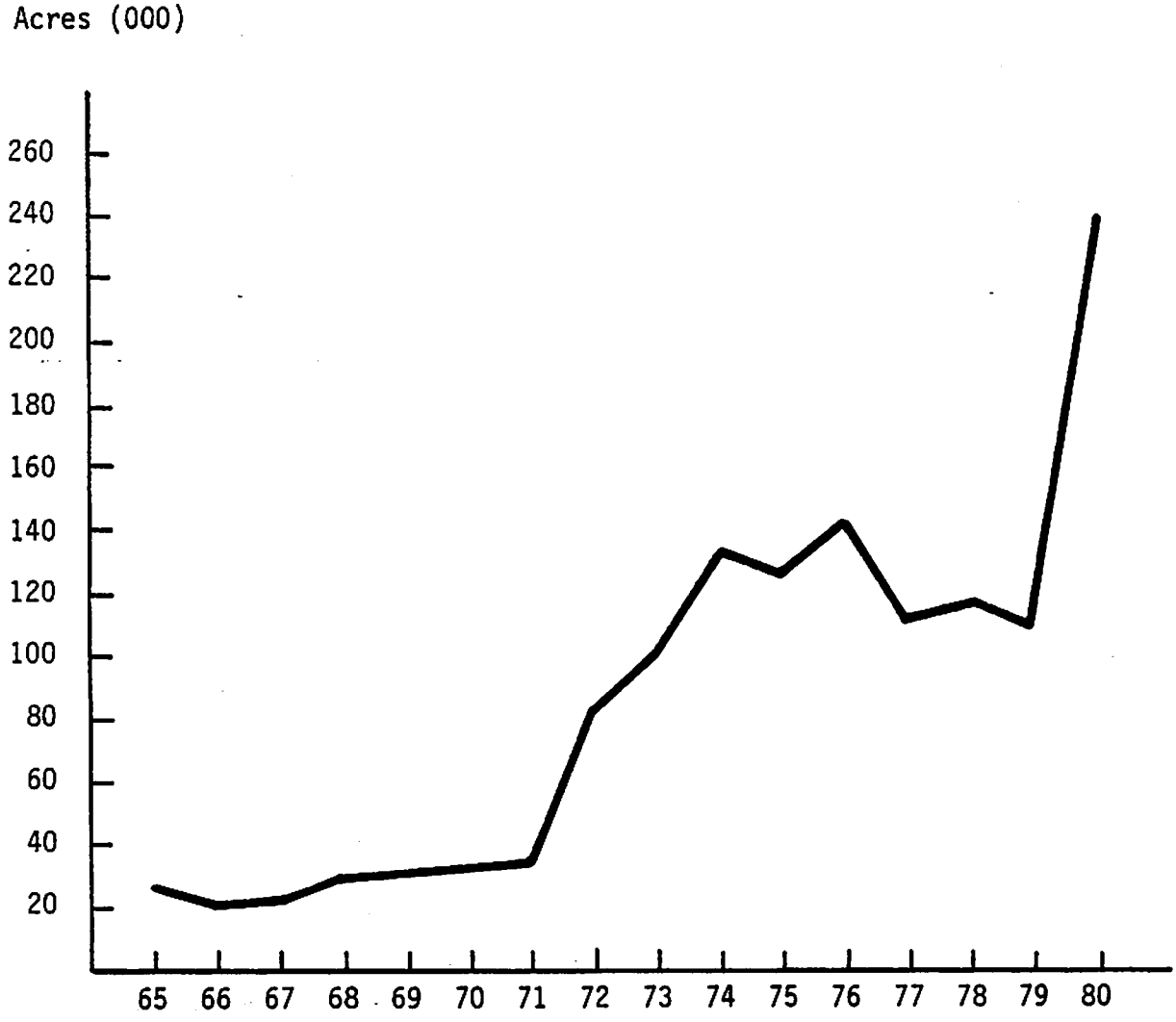

Figure 1. Dry Edible Bean Acres Planted in North Dakota, 1965-1980

Source: North Dakota Crop and Livestock Statistics, Agricultural Statistics Nos. 22-45, Section "Dry Edible Beans," and 1980 Indicated Acreage, Crop Production, August 11, 1980, Section "Dry Edible Beans."

Procedure

This report summarizes data concerning the 1979 crop obtained through personal interviews with 80 producers from four North Dakota counties located in the Red River Valley. The number of producers surveyed by county and bean type is presented in Table 1. Operations performed, material used, and machinery requirements for all phases of dry edible bean production were obtained. The data were summarized in frequency distributions and averages. Summaries were also prepared by farm size and bean type groups in cases where differences were hypothesized to occur.

TABLE 1. NUMBER OF SCHEDULES BY COUNTY AND BEAN TYPE, RED RIVER VALLEY, NORTH DAKOTA, 1979 SURVEY

County	Bean Type			All types
	Navy	Pinto	Mixed	
Cass	15	1	1	17
Grand Forks	0	36	4	40
Traill	0	15	0	15
Walsh	0	7	1	8
All counties	15	59	6	80

Size Characteristics

Farm size classification and selected characteristics of the farms surveyed are presented in Table 2. The dry edible bean enterprise averaged 14 percent of the total cropland acres. The size of enterprise ranged from 26 to 1,500 acres and was closely related to farm size. However, the proportion of acreage devoted to dry edible beans was slightly greater in the small than the medium and large farm groups.

Production and Marketing Practices

Leasing Arrangements

Approximately 41 percent of the dry edible bean acres in the survey were rented, with cash and share rent arrangements constituting almost equal portions of the rented land. The percentage distribution of farmers renting

TABLE 2. NUMBER OF FARMS, AVERAGE CROP ACRES, AVERAGE DRY EDIBLE BEAN ACRES, AND DRY EDIBLE BEAN ACRES AS A PERCENTAGE OF CROP ACRES BY FARM SIZE GROUP, RED RIVER VALLEY, NORTH DAKOTA, 1979

Farm size group	Number of farmers	Range in crop acres	Average crop acres	Average dry edible bean acres	Dry edible bean acres as % of crop acres
Small	27	145- 712	546	100	18
Medium	27	785-1340	1035	143	14
Large	26	1400-5400	2250	302	13
All farmers	80	145-5400	1265	180	14

none, a portion, or all of their bean acres is indicated in Table 3. Smaller farmers rented a higher proportion of land, most commonly on a share basis.

TABLE 3. PERCENTAGE OF PRODUCERS LEASING NONE, PART, OR ALL OF THEIR DRY EDIBLE BEAN ACRES, NORTH DAKOTA, 1979

Tenure group	Percent of producers
All owned land	38.8
Part rented	33.7
All rented	27.5
Total percent	100.0

Cropping Patterns and Rotations

Cropping patterns varied among producers but almost all growers included wheat or barley in their cropping system. A three to four year rotation was used by 88 percent of the producers. Wheat and barley were the most commonly planted crops preceding or following dry edible beans.

Tillage Practices

Several tillage operations were used in dry edible bean production. The preplant tillage operations included plowing or chisel plowing in the fall. Seventy-four percent of the producers plowed once, 6 percent chisel plowed, and about 14 percent performed a combination of plowing and chisel plowing.

The spring preplant tillage operation included several field cultivations or a combination of field cultivations and some other operations such as harrowing and discing. The number of spring tillage operations and the distribution of producers by type of operation is presented in Table 4.

TABLE 4. PERCENTAGE DISTRIBUTION OF PRODUCERS WHO PERFORMED GIVEN SPRING PREPLANT TILLAGE OPERATIONS FOR DRY EDIBLE BEANS, RED RIVER VALLEY, NORTH DAKOTA, 1979

Type of operations*	Percentage of producers
1 cultivate	6.3
1 cultivate & 1 harrow or 1 cultivate & 1 multiweed	7.5
1 cultivate & 2 harrow or 1 cultivate & 2 multiweed	5.0
2 cultivate	15.0
2 cultivate & 1 harrow or 2 cultivate & 1 disc	17.5
2 cultivate & 2 harrow or 2 cultivate & 2 multiweed	8.7
3 or more cultivate	17.5
3 cultivate & 2 harrow	6.3
Other combinations	16.2
Total pct.	100.0

*Not necessarily in order of operation.

Postplant tillage operations mainly included row cultivations. Most growers performed two or more postplant tillage operations as indicated in Table 5.

The average number of tillage operations performed by type of implement and season is presented in Table 6.

Fertilization Practices

Slightly less than half of the total dry edible bean acres in the study were fertilized. Fertilizer application was more common among larger than

TABLE 5. PERCENTAGE DISTRIBUTION OF FARMERS WHO PERFORMED GIVEN POSTPLANT TILLAGE OPERATIONS, DRY EDIBLE BEANS, 1979

Type of operations	Percentage of producers
None	2.5
1 row cultivation	23.7
1 row cultivation and 1 harrowing	6.3
2 row cultivations	46.2
3 row cultivations	15.0
Other combinations	6.3
Total percent	100.0

TABLE 6. AVERAGE TIMES OVER FOR TILLAGE OPERATION BY TYPE OF IMPLEMENT AND SEASON, DRY EDIBLE BEANS, 1979

Operational season	Type of implement	No. of times over
Fall	Moldboard plow	0.87
	Chisel plow	0.35
	Both implements	1.22
Spring	Field cultivator	2.14
	Multiweeder	.39
	Disc	.17
	Harrow	.46
	All implements	3.16
Summer	Row cultivator	1.79
	Harrow	.16
	Both implements	1.95

smaller farmers as indicated in Table 7. The percentage of acres fertilized also increased with farm size.

More fertilizer was used on navy beans than pintos. Eighty-seven percent of the navy bean acres were fertilized as compared to 46 percent of the pinto bean acres. The average pounds of nutrients applied per acre by bean type is presented in Table 8.

TABLE 7. PERCENTAGE DISTRIBUTION OF FARMERS APPLYING FERTILIZER, BY FARM SIZE GROUP, DRY EDIBLE BEANS, 1979

Percent of acres fertilized	Farm size			All producers
	Small	Medium	Large	
	- - - - - - -percent of producers - - - - - - -			
None	74.1	44.5	42.3	53.8
1%-50%	0.0	3.7	3.8	2.5
51%-95%	11.1	7.4	7.7	8.7
Over 95%	14.8	44.4	46.2	35.0
Total pct:	100.0	100.0	100.0	100.0
Average percent	17.4	43.0	61.3	48.2

TABLE 8. AVERAGE APPLICATION RATE OF NUTRIENTS IN POUNDS PER ACRE BY THOSE PRODUCERS APPLYING FERTILIZER, BY BEAN TYPE, 1979

Fertilizer nutrient	Bean type		All producers
	Navy	Pinto	
Nitrogen (N) (pounds)	40.0	27.8	31.7
Phosphate (P_2O_5) (pounds)	18.1	18.0	18.0
Potash (K_2O) (pounds)	0.0	6.3	6.3
Zinc (pints)	3.2	3.2	3.2

Herbicide Applications

All but five growers applied herbicides to control weeds. Treflan was the most common herbicide used by growers of both bean types, and it accounted for 70 percent of all herbicide applications. Eptam, the second most used herbicide, was generally applied in combination with Treflan. However, Eptam was only applied to pinto beans. Few growers used other types of herbicides such as Basagran, Fargo, Amiben, and Tolban.

The most frequent application rates for Treflan and Eptam when applied singly were 1.5 and 4.0 pints per acre, respectively. In cases where they were applied combined, the rates were reduced to 1.0 pint for Treflan and 2.0 pints for Eptam. The herbicide application rates averaged 1.38 pints for Treflan and 2.85 pints for Eptam.

Planting and Seeding

Dry edible beans in the Red River Valley are usually planted after May 20th. The majority of the producers used row crop planters, although grain drills with a wide range of spacings were also used. Table 9 presents the percentage distribution of farmers using different combinations of rows and width of planters. Eight-row planters with 30 or 36 inch spacing were commonly used. In general, planting width for navy beans was narrower than pinto beans because pinto beans produce more vines than navy beans and usually are planted on a wider space.

TABLE 9. PERCENTAGE DISTRIBUTION OF DRY EDIBLE BEAN PRODUCERS USING A GIVEN COMBINATION OF ROWS AND WIDTH OF PLANTERS, BY FARM SIZE, RED RIVER VALLEY, NORTH DAKOTA, 1979

Rows - width (width in inches)	Farm size			All producers
	Small	Medium	Large	
	percent of producers			
None (planted solid)	0.0	3.7	7.7	3.7
4 - 30	11.1	3.7	0.0	5.0
4 - 36	18.6	0.0	0.0	6.3
6 - 30	11.1	22.2	0.0	11.2
8 - 30	37.0	44.5	42.4	41.3
8 - 36	11.1	7.4	11.5	10.0
12 - 22	3.7	7.4	11.5	7.5
12 - 30	3.7	7.4	7.7	6.3
Other	3.7	3.7	19.2	8.7
Total percent	100.0	100.0	100.0	100.0

Seed

All but one grower used certified seed. It is used to ensure protection from seed born blight (mosaic) disease. Two varieties of navy beans and four varieties of pinto beans were planted. Sixty percent of the navy bean growers used the Upland variety and the remainder planted Snow Bunting. The most commonly used pinto bean variety was UI III, planted by almost 70 percent of the pinto bean growers. Other pinto bean varieties included UI 114, Wyo. 111, and Wyo. 166.[1]

[1]Varieties indicate the Agricultural Experiment Station that introduced them. UI stands for University of Idaho, and Wyo. for University of Wyoming.

Navy bean seeding rate ranged from 37 to 47 pounds per acre. The most frequent seeding rate was 40 pounds per acre, used by 38 percent of the growers. The average seeding rate for navy beans was 41 pound per acre.

The seeding rate for pinto beans was generally higher than navy beans, ranging from 40 to 65 pounds per acre. The most frequent seeding rate was 50 pounds per acre, used by 36 percent of the growers. The average seeding rate for pinto beans was about 53 pounds per acre.

Harvesting Operations

Harvesting operations differed among the bean classes. Navy beans were directly combined. Pinto beans, in general, involved several operations and the use of specialized equipment: cutting using a bean cutter; separating the dirt by a rodweeder; windrowing; and combining. Only 44 percent of the pinto bean producers used all three specialized harvesting implements. The remainder used either the rodweeder or the windrower in combination with the bean cutter. The cutter and the rodweeder operation in most cases were performed in combination. Windrowing, however, was usually performed as a separate operation. The most frequently used size of pinto bean harvesting equipment was four-row, as indicated in Table 10.

TABLE 10. PERCENTAGE DISTRIBUTION OF PINTO BEAN PRODUCERS USING A GIVEN SIZE OF HARVESTING EQUIPMENT, RED RIVER VALLEY, NORTH DAKOTA, 1979

Row number	Bean cutter	Rodweeder	Windrower
	percent of producers		
Four	63.6	66.7	53.5
Six	25.5	26.2	32.6
Eight and above	10.9	7.1	13.9
Total percent	100.0	100.0	100.0
No. of observations	55.0	42.0	43.0

Regular grain combines equipped with special bean attachments for cylinder speed reduction and screening to remove dirt were used by 82 percent of the producers. Eleven percent of the producers used bean combines and the remaining 7 percent had the beans custom combined.

Marketing Operations

Eighty-eight percent of the producers delivered their dry edible bean crop directly from the field to the processor for sale or storage. An average of about 46 percent of the 1979 navy bean crop was contracted by the producers surveyed. Contracting by individual growers ranged from 25 to 85 percent of production. No contracting was done by the pinto bean producers surveyed.

An average of 53 percent of the navy bean crop (including that contracted) and 43 percent of the pinto bean crop was sold immediately after harvest. The remainder of the crop was stored for an average period of about four months.

The dry edible bean crop was transported by truck. The number of trucks used by the producers surveyed ranged from one to four; the average number of trucks used was 2.3.

Cost Calculations

Expenses incurred for inputs such as seed, fertilizer, herbicide, custom work, hail insurance and storage were obtained directly from producers. Producers also supplied the information necessary for calculating machinery costs. Such information included field operations performed, the type and size of tractor and equipment used, the ownership period, annual acres covered by the machine, and the speed of travel during the various operations. Current machinery list prices were mainly obtained from the Minnesota Farm Machinery Economic Cost Estimates for 1979 (4) and a few from local dealers. List prices were discounted by 10 percent to represent farmers' actual purchase price for machinery.

Machinery ownership costs include machinery replacement costs, interest on average investment and insurance. A modified double declining balance method of depreciation, which attempts to reflect the remaining market value of machinery, was used to calculate machinery replacement. Since current machinery prices are used, the machinery replacement figures calculated differ from the farmer's depreciation schedule used for income tax accounting. Interest charge on machinery investment was calculated by multiplying the average amount of capital invested in the machine over the ownership period by a 4 percent rate of interest. The 4 percent is an estimated real interest rate over a period of years. This rate differs

from the nominal rate banks and other credit institutions used in 1979[2]. Insurance cost was 0.6 percent of the average investment in a machine. Per acre machinery ownership costs were determined by dividing the annual ownership costs by the annual acres covered by the machine.

Machinery operating costs include repairs, fuel, and lubrication. Studies by Agricultural Engineers on the incidence of repairs of the various types of machines were the basis for determining repair costs (5). Fuel costs were determined by multiplying the tractor's horsepower by the fuel consumption rates (6) and the price per unit of fuel. A price of $.67 per gallon was used for diesel and $.78 per gallon for gasoline. Lubrication costs were assumed to be 15 percent of fuel costs.

Labor hours were calculated as a function of machine capacity (the number of hours required to cover an acre of operation). Operator labor and hired labor were valued at $4.20 per hour.

Land charge was determined based on land rental charges. The land charge was the weighted average of charges for cash and share leasing arrangements per acre. Cash rent averaged $41.72 and share rent averaged $102.85. The weighted average was $74.32 per acre.

Overhead charges were obtained directly from producers. Overhead costs included general farm insurance, truck and pickup licenses, telephone and electricity payments (for farm use only), legal fees and tax filing, farm magazines, and other miscellaneous shop expenses. The average overhead charges by farm size groups were $6.28 for the small, $6.18 for the medium, and $4.55 for the large farms; for navy bean and pinto bean producers they were $4.42 and $5.54 per acre, respectively.

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[2] Real rather than nominal interest rates were used to represent costs in 1979 valued dollars. Nominal interest rates reflect the fact that debts will be repaid in depreciated dollars.

Cost and Return Budgets

Average dry edible bean costs and returns per acre for 1979 in the Red River Valley of North Dakota are presented in Table 11. The total cost (not including charges for risk and management) of producing dry edible beans was $159.30 per acre. Land accounted for the major part of the cost -- 47 percent of the total. Variable cost accounted for about 33 percent of the total cost with 11 percent incurred for seed cost alone.

Total cost slightly decreased with increase in farm size due to the spreading of machinery investments over relatively more acres. Producers with larger machinery also achieved lower labor costs. Labor time, which is a function of machine size, was reduced with increased machinery size.

Total cost per acre of navy bean production was higher than pinto beans. The major difference was accounted for by operating inputs, particularly seed, fertilizer, and crop insurance. Machinery ownership costs, on the other hand, were higher for pinto bean production than for navy beans. This was mainly due to the additional specialized harvesting equipment required for pinto beans.

Producers are often concerned about the size of an enterprise needed to make the most efficient use of the specialized pinto bean harvesting implements. For an investment in four-row equipment and all three implements (bean cutter, rodweeder, and windrower), most economies of size are attained on 125 acres.

The present study indicates that in 1979 dry edible bean production in the Red River Valley paid competitive prices for the resources used and brought a positive return to risk and management. Given the average price of $.194 per pound (weighted average of pinto and navy bean prices received by producers in the study), 55 percent of the average yield (1,497 pounds) was sufficient to cover the costs of production except charges for risk and management. The yield level required to cover the per acre cost of production was higher for navy beans than for pinto beans due to higher cost of production and lower prices received.

TABLE 11. AVERAGE DRY EDIBLE BEAN COST AND RETURN BUDGETS PER ACRE BY FARM SIZE AND BEAN CLASS GROUPS, RED RIVER VALLEY, NORTH DAKOTA, 1979

Item	Farm size			Bean class		All producers
	Small	Medium	Large	Navy	Pinto	
Yield per acre (pounds)	1,490.00	1,446.00	1,556.00	1,650.00	1,476.00	1,497.00
Unit price[a]	$ .195	$ .195	$ .192	$ .158	$ .205	$ .194
Gross returns	290.55	281.97	298.75	260.70	302.58	290.42
Variable costs:						
Seed	17.65	18.06	17.89	20.61	17.13	17.87
Fertilizer	3.34	3.53	5.04	8.07	2.75	3.95
Herbicide	6.02	5.09	6.35	6.41	5.40	5.81
Custom work	1.63	2.77	1.78	3.22	1.69	2.06
Storage	2.33	3.29	2.96	4.14	2.61	2.86
Crop insurance	2.86	3.13	3.57	6.30	2.41	3.18
Machinery repairs	4.93	5.22	5.59	4.78	5.42	5.24
Fuel and lubrication	10.22	9.46	9.27	8.32	9.98	9.65
Interest on oper. cap.[b]	1.20	1.37	1.49	1.65	1.26	1.35
Total variable costs	$ 50.18	$ 51.92	$ 53.94	$ 63.50	$ 48.65	$ 51.97
Returns to labor, machinery, land, overhead, risk, and management	240.37	230.05	244.81	197.20	253.93	238.45
Labor costs:	10.52	9.17	8.27	6.67	9.92	9.33
Machinery ownership costs:						
Machinery replacement and insurance	14.18	13.28	12.39	11.85	13.53	13.29
Interest on machinery investment	6.06	5.15	4.35	3.99	5.51	5.20
Total mach. ownership	$ 20.24	$ 18.43	$ 16.74	$ 15.84	$ 19.04	$ 18.49
Returns to land, overhead, risk and management	209.61	202.45	219.80	174.69	224.97	210.63
Land charges:	74.32	74.32	74.32	74.32	74.32	74.32
Overhead charges:	6.28	6.18	4.55	4.42	5.54	5.19
Returns to risk and mgt.	129.01	121.95	141.93	95.95	145.11	131.12

[a]Average of navy and pinto bean prices including contracting price for navy beans.

[b]A 10.7 percent interest was charged on operating capital from the time each expense was incurred through harvest.

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