DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

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University of Arkansas System
Division of Agriculture
Wheat Research Verification Program

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University of Arkansas
Cooperative Extension Service
Agriculture Experiment Station
U.S. Department of Agriculture
And County Governments Cooperating

Arkansas ROW CROP VERIFICATION
DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

ARKANSAS WHEAT PROMOTION BOARD

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Introduction

The Wheat Research Verification Program (WRVP) represents an interdisciplinary effort of farmers, county Extension agents, Extension specialists, and researchers committed to improving the profitability of wheat production in Arkansas. The WRVP program began in 1986 under the direction of the University of Arkansas Cooperative Extension Service. The Arkansas Wheat Promotion Board has allocated the funding necessary for the WRVP program each year since its inception.

The WRVP program is designed as on-farm demonstrations of all the research-based recommendations required to grow wheat profitably in Arkansas. The WRVP program is part of the University of Arkansas Extension Service's goal of helping wheat producers make economical, agronomical, and environmentally sound decisions on their farms. The specific objectives of the program are:

1. To verify research-based recommendations for profitable wheat production in all wheat producing areas of Arkansas.
2. To develop a database for economic analysis of all aspects of wheat production to demonstrate that consistently high yields of wheat can be produced economically.
3. To identify specific problems and opportunities in Arkansas wheat production for further investigation.
4. To promote timely cultural and management practices among all wheat farmers.
5. To provide training and assistance to county agents with limited expertise in wheat production.

Seven fields were enrolled in the WRVP for the 2020-2021 growing season. Cooperators from the counties selected varieties from a short list provided by the agent and research verification coordinator. These varieties were selected based upon multi-year performance and characteristics determined by the University of Arkansas wheat variety testing program.

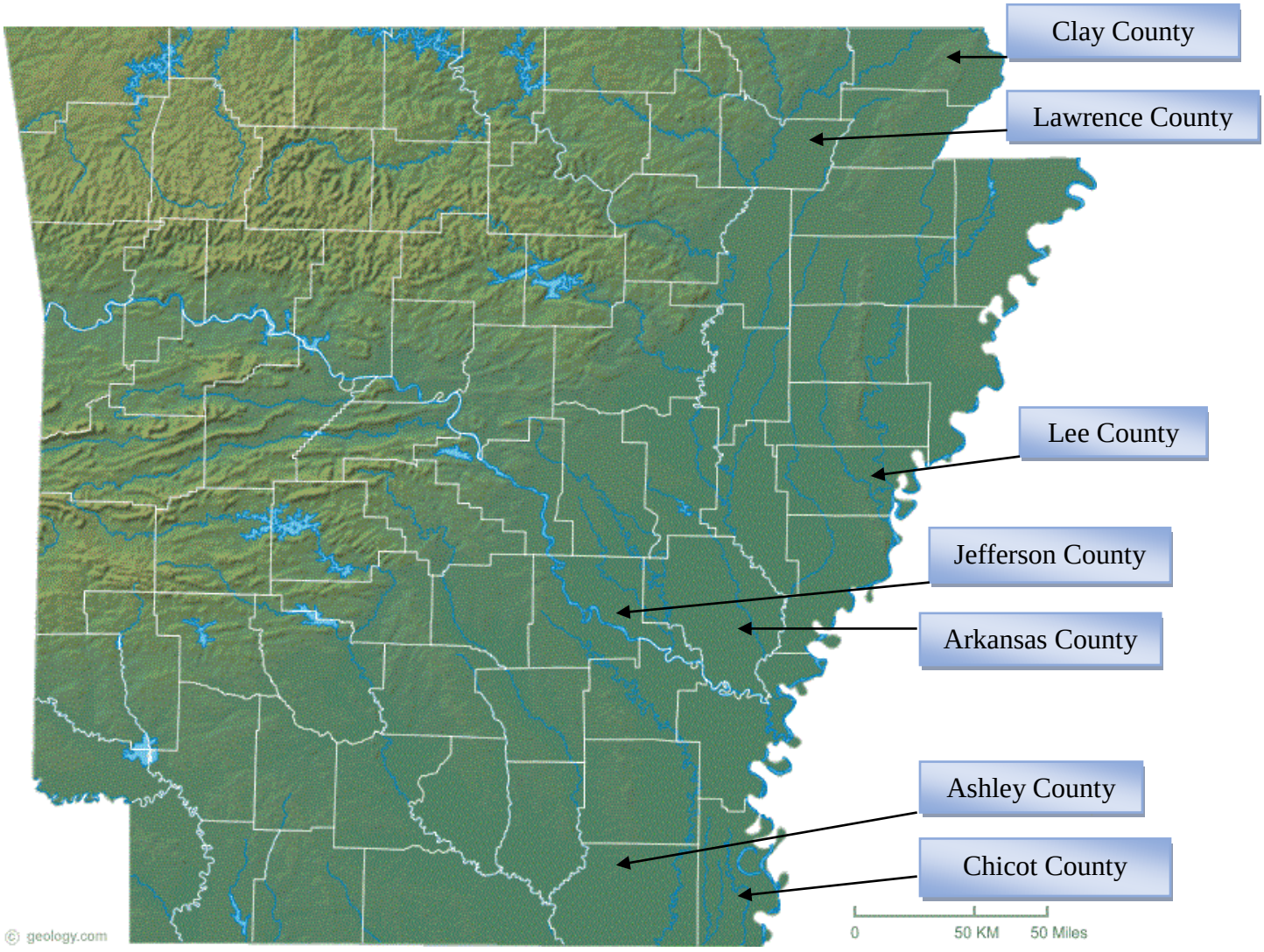
Soil type for fields enrolled in the program were silt loam, silty clay and clay, with previous crops of corn, soybean and one fallow field. Fields were planted in mid-October to mid-November with a seeding rate ranging from 90lbs to 150lbs with Ashley, Chicot, Clay, Jefferson, and Lawrence County fields being drilled on 7.5” rows and Arkansas and Lee County fields being broadcast. The Ashley, Chicot, Jefferson and Lee County fields were sprayed with a fungicide at flowering as a preventative for fusarium head scab. The Arkansas, Chicot, Clay, Jefferson and Lee County fields were treated with herbicides to control broadleaf winter annual weeds. Yields from verification fields ranged from 96.7 bushels/acre in Jefferson County to 50 bushels/acre in Arkansas County.

The 2020-2021 Arkansas wheat production season started with mild weather and good growth. Fields were planted from mid- October through mid- November. The fall of 2020 provided good growing condition with adequate rainfall and average temperatures in late October and early November. Fields had excellent stands and good vegetative growth was seen heading into the winter months.

Spring nitrogen applications were applied starting in late January and continued until middle of March. A February deep freeze slowed plant growth but did not result in freeze damage. Foliar disease levels were generally low for leaf and stripe rust, but with adequate rainfall the potential for Fusarium Head Blight warranted a preventative fungicide treatment in the Ashley, Chicot, Jefferson and Lee County fields. Insect pressure remained low throughout the growing season and no treatment was needed. Wheat research verification fields were harvested early to mid- June. Arkansas producers planted an estimated 220,000 acres of wheat in the fall of 2020 and harvested 155,000 acres. Statewide average yield was estimated at 51 bu/acre. The verification program average yield for the 2020-2021 season was 79.2 bushels/acre.

The Wheat Research Verification Program continues to demonstrate that Extension's research-based recommendations can produce profitable, high yielding wheat across a wide range of conditions and soil types. Over a 30-year period, the WRVP has averaged approximately 12 bushels above the average state yield. The program is funded by wheat check-off dollars and is administered through the Arkansas Wheat Promotion Board.

Figure 1. Locations of 2020-2021 Wheat Research Verification Program Fields



Field Reviews

Southern Fields – Chad Norton

Arkansas County

The 30-acre field, with an Immanuel silt loam, was located south of Tichnor and was fallow during the summer of 2020. Following land preparation and fertilizer application of 0-81-62, according to soil test recommendations, the field was broadcast seeded at 150 pounds/acre on October 27, 2020 with Pioneer P26R41 treated with Cruiser 5FS seed treatment. Wheat emerged November 5 to a plant population of 20 plants/ft². An application of 2 ounces/acre PowerFlex HL plus 2.25 ounces/acre Zidua SC was applied November 10 for emerged and residual ryegrass control. Initial early spring fertilizer application of 100 pounds/acre DAP + 50 pounds/acre Ammonium sulfate + 100 pounds/acre urea applied March 8, 2021 and second spring fertilizer application of 100 pounds/acre urea March 28 resulted in a total spring nitrogen rate of 120 pounds/acre. The field was harvested June 6 and yielded 50 bushels/acre adjusted to 13.5% moisture.

Ashley County

The 40-acre field, with an Arkabutla and Calhoun silt loam soil was located east of Hamburg and followed corn. Following land preparation and a fertilizer application of 0-45-90, according to soil test recommendations, the field was drill seeded October 16, 2020 with AGS 2055 at 110 pounds/acre + Cruiser 5FS and Helena Seed Shield seed treatments. Wheat emerged on October 23 to a plant population of 28 plants/ft². Initial early spring fertilizer application 100 pounds/acre DAP plus 50 pounds/acre Ammonium Sulfate plus 100 pounds/acre urea applied February 8, 2021 and second spring fertilizer application of 100 pounds/acre urea March 10 resulted in a total spring Nitrogen rate of 120 pounds/acre. Miravis Ace fungicide was aerially applied April 3 at 13.7 ounces/acre for Fusarium Head Blight prevention. The field was harvested on June 5 and yielded 86 bushels/acre adjusted to 13.5% moisture.

Chicot County

The 35-acre field with a Sharkey clay soil was located near Eudora and followed soybeans. Fall fertilizer of 0-46-60 was applied according to soil test recommendations. The field was drill seeded October 22, 2020 with Pioneer P26R45 at 120 pounds/acre+ Cruiser 5SF seed treatment. An application of 1 pint/acre gramoxone plus 1.5 ounces/acre Sharpen was applied October 23 to control emerged weeds. Wheat emerged October 29 to a plant population of 26 plants/ft². Another herbicide application of 2.25 ounces/acre Zidua SC was applied November 4 for residual ryegrass control. Initial early spring fertilizer application of 50 pounds/acre Ammonium sulfate plus 130 pounds/acre urea applied March 11, 2021 and second spring fertilizer application of 110 pounds/acre urea March 28 resulted in a total spring Nitrogen rate of 120 pounds/acre. Prosaro fungicide was aerially applied on April 2nd at 8 ounces/acre for Fusarium Head Blight prevention. The field was harvested June 3 and yielded 94.7 bushels/acre adjusted to 13.5% moisture.

Jefferson County

The 73-acre field with McGehee and Rilla silt loams soil was located south of Pine Bluff and followed soybeans. The field was no-till drill planted November 13, 2020 with Local Seed LW2848 at 130 pounds/acre +Cruiser 5FS seed treatment. Gramaxone herbicide was applied at 40 ounces/acre on November 14th to control emerged weeds. Wheat emerged November 23 to a plant population of 22 plants/ft². Fifty pounds/acre urea plus 50 pounds/acre MESZ plus 100 pounds/acre 0-0-60 was applied December 10 for a fall fertilizer rate of 29-20-60. Harmony Extra herbicide was applied at 0.9 ounces/acre for broadleaf weed control. The initial spring fertilizer application of 100 pounds/acre MESZ plus 100 pounds/acre urea applied February 3, 2021 and second spring fertilizer application of 50 pounds Ammonium sulfate plus 50 pounds/acre MESZ plus 100 pounds/acre urea March 8 resulted in a total spring Nitrogen rate of 120 pounds/acre. Prosaro fungicide was aerially applied April 27th at 8 ounces/acre for Fusarium Head Blight prevention. The field was harvested June 15 and yielded 96.7 bushels/acre adjusted to 13.5 moisture.

Lee County

The 64-acre field with a Commerce silt loam and Tunica silty clay soil was located southwest of Brickeys and followed corn. Following land preparation, the field was broadcast seeded October 21, 2020 at 100 pounds/acre with Local Seed LW2848+Cruiser 5SF seed treatment. Wheat emerged October 28 to a plant population of 21 plants/ft². An application of 2 ounces/acre of Zidua SC herbicide was made on November 1 for residual ryegrass control. Initial early spring fertilizer application of 75 pounds/acre DAP plus 75 pounds/acre Ammonium sulfate was applied January 25, 2021. Harmony Extra was applied March 22nd at 0.9 ounces/acre for broadleaf weed control. The second spring fertilizer application of 130 pounds/acre urea March 10 and third spring application of 70 pounds/acre urea April 10 resulted in a total spring Nitrogen rate of 120 pounds/acre. Folicur fungicide was aerially applied at 4 ounces/acre for foliar disease suppression on April 19. The field was harvested June 18 and yielded 78 bushels/acre adjusted to 13.5% moisture.

Northern Fields – Chris Elkins

Clay County

The 35-acre field with a Fountain silt loam soil was located east of Piggott and followed corn. Following land preparation, a pre-plant fertilizer application of 12-36-72 was applied. The field was drilled planted on October 16, 2020 with Dixie Bentley at 120 pounds/acre. Wheat emerged on October 23, 2020 to a stand of 16.8 plants/ ft². Initial early spring fertilizer application of 50lbs/acre Ammonium Sulfate plus 50lbs/acre Urea on March 4, 2021 followed by 100lbs Urea on March 9, 2021. The final spring Nitrogen application of 100lbs Urea was applied on March 22, 2021 for a total spring Nitrogen rate of 125 pounds/acre. One herbicide application of 0.9oz Harmony Extra was applied on March 30, 2021 for broadleaf weed control. The field was harvested June 19 and yielded 61.9 bushels/acre.

Lawrence County

The 30-acre field with an Amagon and Dundee silt loam soil was located northeast of Walnut Ridge and followed soybeans. A pre-plant fertilizer of 0-43-86 was applied and the field was no-till planted on 7.5" row spacing on October 15, 2020 with Delta Grow 1000 at 90 pounds/acre + Apron XL seed treatment. Wheat emerged on October 22, 2020 to a stand of 22.6 plants/sq.ft. Initial early spring fertilizer application of 50lbs/acre Ammonium Sulfate plus 50lbs/acre Urea on February 25, 2021 followed by a second application of 22 lbs Ammonium Sulfate plus 88 lbs/acre Urea on March 10, 2021. Final application of spring fertilizer of 15 gallons of 28% UAN was applied on March 22, 2020 for a total spring Nitrogen rate of 123 pounds/acre. The field was harvested on June 17, 2021 and yielded 86.0 bushels/acre.

Table1. General Agronomic Information of Verification Fields in 2020-2021.

County	Variety	Acres	Planting Method and Rate	Planting Date	Previous Crop	Yield Bu/a
Arkansas	Pioneer P26R41	30	Broadcast 150 lbs.	10/27/20	Fallow	50
Ashley	AGS 2055	40	Drill 110 lbs.	10/16/20	Corn	86
Chicot	Pioneer P26R45	35	Drill 120 lbs.	10/22/20	Soybean	94.7
Clay	Dixie Bentley	35	Drill 120lbs.	10/16/20	Corn	61.9
Jefferson	Local Seed LW2848	73	Drill 130 lbs.	11/13/20	Soybean	96.7
Lawrence	Delta Grow 1000	30	Drill 90 lbs.	10/15/20	Soybean	86
Lee	Local Seed LW2848	64	Broadcast 100 lbs.	10/21/20	Corn	79.3
Average						**79.2 bu/A**

Table 2. Soil Type and Fertilizer Inputs for 2020-2021 Wheat Verification Fields.				
County	**Soil Type**	**Fall Fertilizer**	**Spring Fertilizer**	**Total Spring Nitrogen**
Arkansas	Immanuel silt loam	0-81-62	1st; 100 lbs. DAP + 50 lbs. Ammonium sulfate + 100 lbs. Urea 2nd; 100 lbs. Urea	120
Ashley	Arklabutla, Calhoun silt loam	0-45-90	1st; 100 lbs. DAP + 50 lbs. Ammonium sulfate + 100 lbs. Urea 2nd; 100 lbs. Urea	120
Chicot	Sharkey clay	0-46-60	1st; 50 lbs. Ammonium sulfate + 130 lbs. Urea 2nd; 110 lbs. Urea	120
Clay	Fountain Silt loam	12-36-72	1st; 50 lbs. Ammonium sulfate + 50 lbs. Urea 2nd; 100 lbs. Urea 3rd; 100 lbs. Urea	125
Jefferson	McGehee, Rilla silt loam	29-20-60	1st; 100 lbs. urea + 100 lbs. MESZ 2nd; 50 lbs. Ammonium sulfate +50 lbs. MESZ + 100 lbs. Urea	120
Lawrence	Amagon silt loam, Dundee silt loam	0-43-86	1st; 50 lbs. Ammonium sulfate + 50 lbs. Urea 2nd; 22 lbs. Ammonium Sulfate + 88 lbs. Urea 3rd; 15 gal. 28% UAN	123
Lee	Commerce silt loam, Tunica silty clay	0-0-0	1st; 75 lbs. DAP + 75 lbs. Ammonium sulfate 2nd; 130 lbs. Urea 3rd; 70 lbs. Urea	120
Average		6-39-61		**121 lbs N**

Table 3. Pesticide Information for the 2020-2021 Wheat Verification Fields.			
County	**Herbicide**	**Insecticide**	**Fungicide**
Arkansas	Fall post-emerge; 2 oz./ac PowerFlex HL + 2.25 oz./ac. Zidua SC	None	None
Ashley	None	None-	13.7 oz./ac. Miravis Ace
Chicot	Fall burndown; 1 pt./ac. gramoxone. Fall post-emerge; 2.25 oz./ac. Zidua SC	None	8 oz./ac. Prosaro
Clay	Post-emerge; .9oz/ac. Harmony Extra + .25% NIS	None	-
Jefferson	Fall burndown; 40 oz./ac. Gramoxone. Spring post-emerge; .9 oz./ac. Harmony Extra + .25% NIS	None	8 oz./ac. Prosaro
Lawrence	None	None	-
Lee	Fall post-emerge; 2 oz./ac. Zidua SC Spring post-emerge; .6 oz./ac. Harmony Extra + 1% NIS	-	4 oz./ac. Folicur

Economic Analysis of the 2021 Wheat Research Verification Program

This section reports information on costs and returns for the 2021 Wheat Research Verification Program (WRVP). Records of field operations on each field are the basis for estimating these costs. The field records were compiled by the WRVP coordinators, county Extension agents, and cooperators. Production data from the 7 fields were applied to determine costs and returns above operating costs, as well as total specified costs. Operating costs per bushel and total costs per bushel indicate the commodity price needed to meet each costs type.

Production expenses are those expenditures that would generally require annual cash outlays and would be included on an annual operating loan application. Actual quantities of all production inputs as reported by the cooperators are used in this analysis. Input prices are determined by data from the 2020 Crop Enterprise Budgets published by the Cooperative Extension Service. Fuel and repair costs for machinery are calculated using a budget calculator based on parameters and standards established by the American Society of Agricultural and Biological Engineers. Machinery repair and maintenance costs should be regarded as estimated values, and actual cash outlays could differ as producers utilize employee labor for equipment maintenance.

Ownership costs of machinery are determined by a capital recovery method which determines the amount of money that should be set aside each year to replace the value of equipment used in production. Machinery costs are estimated by applying engineering formulas to representative prices of new equipment. This measure differs from typical depreciation methods, as well as actual annual cash expenses for machinery.

Operating costs, total costs, costs per bushel, and returns are presented in Table 4. Costs in this report do not include land costs, management, or other expenses and fees not associated with production. Budget summaries for wheat are presented in Table 4. Price received for wheat of $5.50/bu. for Northern fields and 5.50/bu. for Southern fields is determined by the Arkansas average cash price during the reported harvest period of the WRVP fields. Average wheat yield is 79.2 bu. per acre.

Average operating costs for wheat in Table 4 are $261.20 per acre. Table 5 indicates that fertilizers and nutrients are the largest expense category at $95.14 per acre, or 36% of total production expenses. Seed cost is the second largest expense category at $43.71 per acre, or 16.5% of total production expenses.

With average yield of 79.2 bu. per acre, average operating costs are $3.50/bu. Operating costs range from a low of $217.47 per acre in Lawrence County to a high of $343.63 per acre in the Jefferson County field. Returns to operating costs average $167.14 per acre. The low is $6.39 in Arkansas County, and the high is $264.04 in Chicot County. Average fixed costs are $50.80 per acre which leads to average total costs of $312.00 per acre. Returns to total costs average $116.45 per acre with a low of -$33.50 in Arkansas County and a high of $213.37 in Lawrence County. Total specified costs average $4.18/bu.

Table 4. 2021 Operating Costs, Total Costs, and Returns

Field	Operating Costs	Operating Costs per Bushel	Returns to Operating Costs	Total Fixed Costs	Total Costs[1]	Returns to Total Costs	Total Costs per Bushel
Arkansas	268.61	5.37	6.39	39.89	308.50	-33.50	6.17
Ashley	254.78	2.96	218.22	71.53	326.31	146.69	3.79
Chicot	256.81	2.71	264.04	50.67	307.48	213.37	3.25
Clay	239.31	3.87	101.14	50.17	289.48	50.97	4.68
Jefferson	343.63	3.55	188.22	43.73	387.36	144.49	4.01
Lawrence	217.47	2.53	255.53	44.08	261.55	211.45	3.04
Lee	247.77	3.54	137.23	55.52	303.29	81.71	4.33
Average	**261.20**	**3.50**	**167.25**	**50.80**	**312.00**	**116.45**	**4.18**

[1]Does not include land costs, management, or other expenses and fees not associated with production.

Table 5. 2021 Revenue and Expenses per Acre

	Field							
Revenue	Arkansas	Ashley	Chicot	Clay	Jefferson	Lawrence	Lee	**Average**
Yield (bu.)	50.0	86.0	94.7	61.90	96.70	86.0	70.0	79.2
Price ($/bu.)	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Total Crop Revenue	**275.00**	**473.00**	**520.85**	**340.45**	**531.85**	**473.00**	**385.00**	**435.60**
Expenses								
Seed	55.50	51.70	44.40	36.00	48.10	33.30	37.00	43.71
Fertilizers & Nutrients	89.17	87.07	69.09	127.93	133.78	97.15	61.81	95.14
Chemicals	35.36	17.13	55.80	10.80	67.86	0.00	30.84	31.11
Custom Applications	31.00	16.00	16.80	39.5	24.00	23.00	43.60	27.70
Diesel Fuel	7.61	17.55	11.36	10.90	9.33	9.51	13.31	11.37
Irrigation Energy Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Input Costs	**218.64**	**189.45**	**197.45**	**225.13**	**283.07**	**162.96**	**186.56**	**209.03**
Crop Insurance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Repairs & Maintenance[1]	8.67	15.15	11.49	11.96	10.62	10.96	11.99	11.55
Labor, Field Activities	2.99	9.93	5.20	4.94	4.40	4.29	6.00	5.39
Production Expenses	**240.30**	**224.53**	**224.14**	**252.03**	**308.09**	**188.21**	**214.55**	**235.97**
Interest	6.81	6.17	6.16	5.94	8.47	5.18	6.11	6.41
Post-harvest Expenses	14.00	24.08	26.52	17.33	27.08	24.08	19.60	21.81
Total Operating Expenses	**268.61**	**254.78**	**256.81**	**239.31**	**343.63**	**217.47**	**247.77**	**261.20**
Returns to Operating Expenses	**6.39**	**218.22**	**264.04**	**101.14**	**188.22**	**255.53**	**137.23**	**167.25**
Capital Recovery & Fixed Costs	39.89	71.53	50.67	50.17	43.73	44.08	55.52	50.80
Total Specified Expenses[2]	**308.50**	**326.31**	**307.48**	**289.48**	**387.36**	**261.55**	**303.29**	**312.00**
Returns to Specified Expenses	**-33.50**	**146.69**	**213.37**	**50.97**	**144.49**	**211.45**	**81.71**	**116.45**
Operating Expenses/bu.	5.37	2.96	2.71	3.87	3.55	2.53	3.54	3.50
Total Specified Expenses/bu.	6.17	3.79	3.25	4.68	4.01	3.04	4.33	4.18