

*Economics of  
Yellow Mustard  
in the  
Pacific  
Northwest*

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BUL 826



Farmers in the Pacific Northwest (PNW) continue to search for crop alternatives that will fit into this region's traditional cereal rotations. Rapeseed, canola, safflower, and sunflower are among the alternative crops that have been tried in the past with varying degrees of success. Another alternative crop that is drawing the interest of area farmers is yellow mustard (*Sinapis alba* L.). While limited acreage of yellow mustard has been grown in the past in the PNW, a recent increase in acreage has occurred.

Agronomically, mustard has proven adaptable to a wide range of growing conditions and precipitation zones found in the PNW. Mustard is grown on dryland farms in Washington, Oregon and Idaho in areas receiving from 8 inches to more than 20 inches of annual rainfall. Mustard is compatible with other crops in rotation and can enhance weed and disease control. In addition, mustard production uses equipment already in use on these farms, and may allow for more efficient use of machinery resources by extending seeding and harvesting seasons.

This report addresses the economic feasibility of producing mustard in the PNW. Specific topics reviewed include yield potential, supply and demand considerations, markets and prices, and production costs associated with yellow mustard.

## Survey of PNW Growers

Surveys of yellow mustard growers on farms in eastern Oregon, eastern Washington, and

northern Idaho were conducted for the 1997 and 1998 crops. Fifty-five growers participated by mail or telephone for the 1997 crop, while thirty-three growers participated in the survey for the 1998 crop. The 1997 survey included most of the growers in the three-state area, with a total harvested acreage of 9,451. The 1998 survey included 9,100 harvested acres. It was mainly a follow-up of growers that participated in the 1997 survey. Growers provided information on rotations, cultural practices, production, and markets.

## Precipitation and Yields

Precipitation is a major factor influencing yields of yellow mustard (Fig. 1). Respondents' farms were placed in one of three rainfall groups: less than 13 inches, 13 to 16 inches, and more than 16 inches. Survey respondents reported annual

rainfall for their geographic area, acres harvested and yields per acre (Table 1).

Farmers in the lower rainfall areas in the PNW have shown the most interest in adopting yellow mustard. These lower rainfall areas have fewer crop alternatives to rotate with wheat and fallow, so farmers are trying yellow mustard despite the lower yields in these areas. Higher rainfall areas tend to have more crop alternatives, such as peas, lentils, and canola.

Crop yields from the surveyed yellow mustard growers show considerable variability not only among precipitation areas, but also within each area. For example, 1997-98 yields ranged from 280 to 1,247 lb per acre in the less than 13-inch rainfall zone, from 400 to 1,551 lb per acre for the 13-inch to 16-inch rainfall zone, and from 600 to 2,500 lb per acre for the over 16-inch rainfall zone. Average yields, illustrated in Fig. 1,

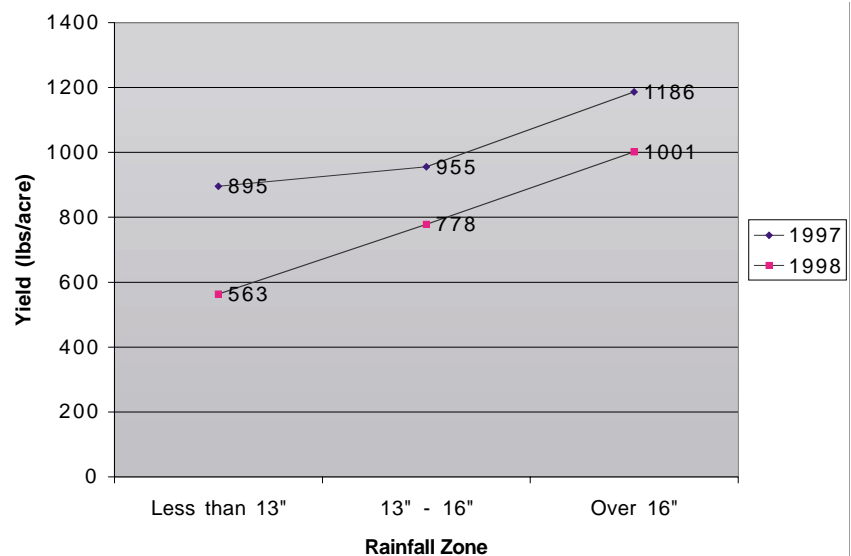


Fig. 1. Average mustard yields by rainfall zone, 1997 and 1998 surveys of growers.

**Table 1. Yellow mustard acreage and yield (lb/acre) by precipitation zone in the Pacific Northwest.**

Average annual rainfall (inches)	1997 survey of growers			1998 survey of growers		
	Acres	Avg. yield (bu/acre)	No. of farmers	Acres	Avg. yield (bu/acre)	No. of farmers
Less than 13	3,967	895	21	6,633	563	19
13 to 16	3,488	955	15	1,203	778	8
More than 16	1,996	1,186	19	1,267	1,001	6
All zones	9,451	979	55	9,103	652	33

Sources: 1997 and 1998 surveys.

ranged from 59 percent higher in 1997 for the lowest rainfall zone, to 23 percent higher in the medium rainfall zone, to 18 percent higher in the highest rainfall zone. Weighted average yields for the region across all rainfall zones in 1998 were just two-thirds of the 1997 yields (Table 1).

As a relatively new crop for this region, there is a scarcity of agronomic information on yellow mustard. Further research and information from growers should help improve yield potential and reduce variation in yields. In addition, the development of new varieties adapted to this region could greatly increase crop yield, as the current varieties were developed and adapted for growing conditions in Europe and Canada.

## Markets and Price

Before a crop is grown, the producer should analyze marketing information and know how and where it is to be marketed. The grower has the option of contracting the crop for a specified price or selling it on the open market. If the crop is to be sold on the open market, it is advisable for the grower to have access to information on past

prices and what influences affect the market price.

The yellow mustard market is currently quite limited and could easily be oversupplied. The marketplace determines the price that buyers can pay on contracted seed and also what the price will be in the open market. The price farmers receive for mustard seed is governed by how much product the processors need and by the supply that is currently available.

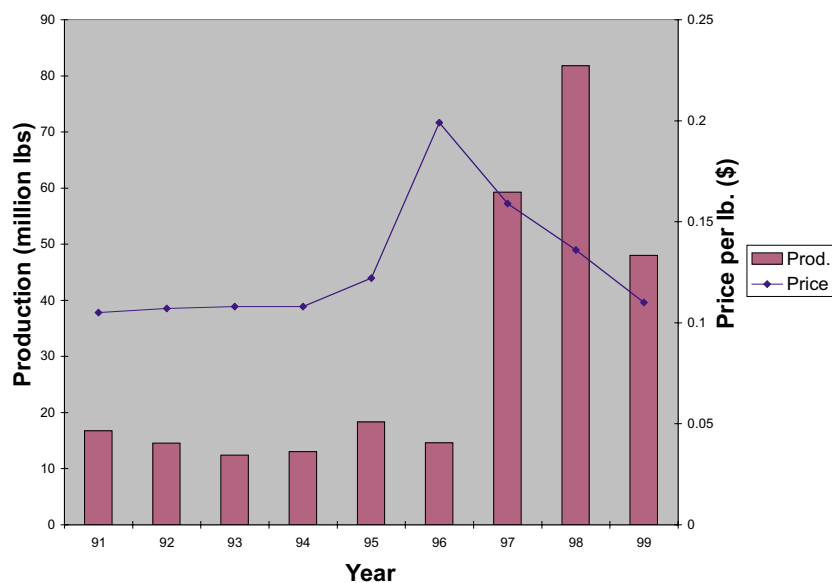
Buyers must know the price required to encourage growers to include mustard in their crop agenda. If wheat, barley, or some other crop promises a higher return than mustard, then mustard acreage will be reduced or eliminated. In general, farmers raise crops for which the return above costs are expected to be highest, providing risk is not substantially increased. In the end, it is the return per acre of crop rotation that is important to the farm operator. A low-income crop can feasibly be included if it increases productivity of crops that follow in the rotation. While yellow mustard has been credited with benefiting following grain crops, this has not been statistically verified.

Regardless of whether the crop is contracted or sold on the open market, the grower should know what it will cost to produce the crop. This information is necessary to estimate whether or not the price is high enough to bring a return above cost. This knowledge is also useful when comparing mustard with other crop alternatives. Cost budgets are presented in the appendix of this report for the 20-inch rainfall zone of northern Idaho and eastern Washington.

## Historical Production, Prices and Consumption For Yellow Mustard

A comparison of prices received and quantity produced for yellow mustard in the U.S. from 1991 through 1999 is presented in Fig. 2. A delayed effect of changes in total production on price is observed. The average annual price of yellow mustard has ranged from a low of \$0.10 per pound in 1991 to a high of \$0.17 in 1996, while production has ranged from 12.38 million pounds in 1993 to 81.75 pounds in 1998.

As previously noted, the demand for yellow mustard in the U.S. is rather limited and hence



**Fig. 2. U.S. price and production data for yellow mustard, 1991-1999 (USDA/NASS).**

the possibility of overproduction should be considered. Average yearly U.S. consumption of yellow mustard seed, mustard oil, and mustard flour from 1994 to 1997 was approximately 170 million pounds. Dividing average consumption by average yield per acre from 1991 to 1999 indicates that about 198,000 acres would be necessary to supply the average yearly demand in the U.S. Given the acreage harvested in 1998 and 1999, an additional 98,000 to 135,000 acres would be required to satisfy the U.S. market. Domestic mustard production could easily exceed this acreage if it were economically advantageous.

U.S. growers are in competition with growers in other countries as well as among themselves. Relative costs for domestic production and imports were not determined, but buyers will obtain seed wherever they can get the quality desired at the lowest price. The

portion of the nation's mustard supply satisfied by domestic production ranged from 7 percent in 1994 to 34 percent in 1998. Historically, a large share of the U.S. yellow mustard supply has been imported from Canada. From 1993 to 1999, cultivation of mustard in Canada averaged 655,326 acres, while overall production averaged 544.4 million pounds, according to statistics from the Food and Agricultural Organization of the United Nations (FAO). Over the same time period, the average U.S. production was 35.3 million pounds. In any case, the need for acreage of yellow mustard in the U.S. is limited until new markets can be developed.

### **Future Market Potential**

Possibilities for future demand expansion for mustard have been suggested. Plant scientists are in the process of developing mustards for new uses, such as a canola quality oil

usable in the food market. Another type that is gaining considerable interest is a hot mustard, which is toxic to nematodes and other harmful soil-borne organisms. This mustard could be plowed down and used as a soil fumigant, saving money and providing an environmentally friendly method of fumigation. If this becomes feasible there would be a large market for this type of mustard seed. Another possible but less likely use of mustard seed would be to produce oil for bio diesel and specialized lubricants. Development of an export market for mustard seed and its products could also be considered. While these ideas are speculative at present, they do offer some encouragement that yellow mustard and other mustard cultivars may develop into a viable alternative crop for farmers in the PNW.

### **Costs of Raising Yellow Mustard in the Pacific Northwest**

Costs of growing yellow mustard have been estimated from information provided by growers who participated in the 1997-98 survey. These farmers supplied data on their production practices, machinery complement, and input usage. *Fertilizer Recommendations*

Research at the University of Idaho has found that yellow mustard requires less fertilizer than canola. Overapplication of nitrogen fertilizer (N) may cause problems that increase the risk of lodging, such as delayed flowering and excessive vegetative growth. Rainfall and yield potential largely determine the

**Table 2. Fertilizer recommendation ranges for yellow mustard by rainfall levels, PNW.**

Average annual rainfall (inches)	Recommended fertilizer ranges		
	N	P	S
Less than 13	40-60	0-5	0-5
13 to 16	55-75	0-10	0-10
More than 16	80-100	5-15	5-15

Sources: 1997 and 1998 surveys; Franzen 1992; Esser 1998.

amount of fertilizer needed to produce a crop.

Soil tests should be obtained to help estimate fertilizer requirements. In high rainfall areas, application rates of N should not exceed 100 lb per acre and total available nitrogen should not exceed 220 lb per acre. Unlike canola, yellow mustard is not very responsive to sulfur applications. High application rates of sulfur may actually be detrimental to seed quality. General fertilizer recommendations by rainfall area are presented in Table 2.

### Weed Control

Currently, the only herbicide registered for use on yellow mustard is Treflan®. Fortunately, weeds are less problematic in mustards than in other spring crops such as canola, peas, or lentils. Survey results revealed that fewer than 15 percent of the yellow mustard growers used herbicides. With the exception of wild oats in high rainfall areas and Russian thistle in lower rainfall areas, most growers did not find weed control in mustard to be a problem. However, an application of Treflan® may be needed on some farms.

### Insect Control

Up to this point, yellow mustard has tolerated insects that infest canola and rapeseed. Because of this, insecticides are not usually needed on this crop. No grower in the 1997 and 1998 surveys reported using insecticide on mustard and no insect problems were mentioned.

### Farm Size, Rotation, and Tenure Assumptions

This series of enterprise budgets (see Appendix) represents a farm raising mustard in the 20-inch rainfall zone of northern Idaho or eastern Washington. An enterprise budget, or costs and returns estimate, includes estimates of both variable (or operating) costs, and fixed (or ownership) costs. Operating costs include such items as fertilizer, seed, fuel, labor, repairs, and crop insurance. Fixed costs include items like depreciation, interest, land rent, property taxes, and management. The costs in this budget represent estimates for an 1800-acre farm utilizing a three-year rotation of winter wheat, spring barley, and lentils or mustard. The rotation consists of 600 acres of wheat, 600 acres of spring barley, 500 acres of lentils, and 100 acres of

mustard. The lease arrangement is assumed to be a one-third/two-thirds owner/leasee sharecropping arrangement, with the landowners paying their share of chemical and fertilizer expenses. *Price and Yield Assumptions*

The 1100-pound yield estimate represents the average yield obtained in 1997 and 1998 from surveyed growers in the 20-inch rainfall area. The mustard price received by growers was 12 cents per pound, slightly below the 1991-99 U.S. average mustard price of 12.7 cents per pound. This price estimate falls in the middle of the 11- to 13-cent price range suggested by industry personnel.

### Input and Cultivation Assumptions

The fertilizer rate for this budget was estimated at 80 lb of nitrogen (N), 10 lb of phosphorus (P), and 10 lb of sulfur (S). The seeding rate was 10 lb per acre. No herbicides or insecticides were included in this budget. Conventional tillage practices were assumed, including a fall chisel plowing followed by a spring harrowing, two cultivations, seeding, and rolling the seedbed.

### Total Costs and Returns Estimates

Total operating costs, including fertilizer, seed, labor, fuel, repairs, hail insurance, and interest on operating capital, were estimated to be \$86 per acre (see Appendix Table 1). Total cash ownership costs (land rent, management, general overhead, property taxes, and insurance) were estimated at \$45 per acre.

**Table 3. Summary of costs and returns (\$ per acre) for four rotational crops in the 20-inch rainfall region.**

Crop	Gross returns	Cash operating expenses	Cash ownership costs	Net cash returns	Noncash ownership costs	Total costs	Net returns to risk
	-----\$/acre-----						
Winter wheat	281	108	98	75	49	255	26
Spring barley	147	110	47	<10>	58	215	<68>
Spring lentils	200	105	59	36	72	237	<36>
Yellow mustard	132	86	45	1	47	177	<45>

Sources: 1997-98 grower survey and budget calculations.

Non-cash ownership costs (depreciation and interest on equipment) were \$47 per acre. Total costs per acre for raising yellow mustard were estimated to be \$177 per acre. With a gross return of \$132 per acre, the net loss was \$45 per acre. Net cash return, which excludes depreciation expenses and interest on equipment investment, was a nearly break-even situation at \$1 per acre. This cash return calculation assumes that all labor is hired, management is paid, and land is rented. There would be a higher cash return if the operator furnished these items and owned the farm.

Costs and returns estimates were also generated for the other three crops in the rotation on the 1800-acre farm. The same machinery complement was used for all of the crops in the rotation. A summary of the results of all four budgets is shown in Table 3. Variable input costs were based on 1999 prices. Fixed or ownership costs estimates for machinery were assumed at 75 percent of replacement cost. This assumption affects depreciation and interest and more closely represents typical machinery components, in which some machinery is purchased used and some is kept on

the farm after normal depreciation has been taken. Labor costs include wages plus benefits. The management fee is estimated at 5 percent of gross returns for the enterprise.

In this budget, all crops except spring barley showed a positive cash return, but only wheat was profitable when all economic costs were included (Table 3). Yellow mustard was more profitable than barley but less profitable than lentils. Costs and returns estimates for all of the crops in the rotation are shown in the appendix at the end of this publication.

### Summary and Conclusions

Agronomically, yellow mustard is a viable alternative crop for crop rotations of the Pacific Northwest (PNW). It utilizes existing equipment on grain farms in the area. As an alternative crop, yellow mustard would increase diversification for the farm operator and may be helpful in weed and disease control. Mustard competes well with weeds, so it requires fewer chemicals for weed and insect control than other commonly grown crops.

Acreage of yellow mustard grew from an average of 17,000 acres in the U.S. between 1992

and 1996 to 95,600 acres in 1998, but then fell to 58,200 in 1999. While this increase indicates interest in this new crop, there is concern about the capacity of the market to absorb more growth. Further expansion beyond a modest increase will have to come at the expense of Canadian production or from increased demand. It is hoped that new uses for mustard combined with development of new mustards with unique characteristics will expand the market for this crop.

At prices prevalent for most of the 1990s, yellow mustard appears to be competitive with barley, dry peas, lentils or similar spring crops. Net per acre cash returns were \$1 per acre, compared to -\$10 per acre for spring barley and \$36 per acre for spring lentils. Farmers considering production of yellow mustard should contact other growers in their area, if possible, for information on their experiences with this crop. Ideally, growers should experiment with a few acres to determine how the crop performs in a particular environment and obtain a contract with a fixed price before seeding.

# Appendix

## Cost and Returns Budgets for the 20-inch Rainfall Region of Northern Idaho and Eastern Washington

### Crops included:

**Yellow Mustard (pages 8-10)**

**Winter Wheat (pages 11-13)**

**Spring Barley (pages 14-16)**

**Lentils (pages 17-19)**

**Appendix Table 1a: Monthly summary of cash expenses per acre for production of yellow mustard seed.**

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Mustard	1100.00	lb	0.12	132.00	
Total Gross Returns For Mustard				132.00	
Operating Costs					
Custom:					
Sprayer	1.00	acre	1.50	1.50	
Pesticide:					
Roundup	16.00	oz	0.35	5.60	
Fertilizer:					
Nitrogen	80.00	lb	0.21	16.80	
Phosphate	10.00	lb	0.25	2.50	
Sulfur	10.00	lb	0.18	1.80	
Seed:					
Mustard seed	10.00	lb	1.25	12.50	
Other:					
Crop Insurance	1.00	acre	3.60	3.60	
Labor (machine)	1.52	hrs	13.30	20.28	
Labor (non-machine)	0.00	hrs	0.00	0.00	
Fuel - Gas	2.06	gal	1.50	3.09	
Fuel - Diesel	7.82	gal	0.90	7.04	
Lube				1.52	
Machinery repair				5.96	
Interest on operating capital @ 9.75%				3.98	
Total Operating Costs/acre				86.16	
Net Returns Above Operating Costs				45.84	
Cash Ownership Costs					
General Overhead				3.19	
Land Rent				31.02	
Management Fee				6.60	
Property Taxes (Machinery)				2.77	
Property Insurance				0.99	
Total Cash Ownership Costs/acre				44.56	
Non-Cash Ownership Costs (Depreciation and Interest)					
Equipment				46.69	
Total Non-Cash Ownership Costs/acre				46.69	
Total Costs/acre				177.41	
Returns to Risk				-45.41	



**Appendix Table 2a: Monthly summary of cash expenses per acre for production of yellow mustard seed.**

	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Mar 98	Apr 98	May 98	Jun 98	Jul 98	Aug 98	Total
<b>Preharvest:</b>													
Ground Spray	9.65												9.65
Plow	4.24												4.24
Fertilize								22.78					22.78
Cultivate								1.99					1.99
Harrow								0.90					0.90
Seed Hauling								2.08					2.08
Plant								15.53					15.53
Crop Insurance								3.60					3.60
General Farm Truck Use	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	12.24
<b>Total Preharvest Costs</b>	<b>14.91</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>47.90</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>73.02</b>
<b>Harvest:</b>													
Combine												7.09	7.09
Crop Hauling												2.08	2.08
<b>Total Harvest Costs</b>												<b>9.17</b>	<b>9.17</b>
Interest on Operating Capital	0.12	0.13	0.14	0.15	0.15	0.16	0.17	0.56	0.57	0.58	0.58	0.67	3.98
<b>Operating Costs/acre</b>	<b>15.03</b>	<b>1.15</b>	<b>1.16</b>	<b>1.17</b>	<b>1.17</b>	<b>1.18</b>	<b>1.19</b>	<b>48.46</b>	<b>1.59</b>	<b>1.60</b>	<b>1.61</b>	<b>10.85</b>	<b>86.16</b>
<b>Cash Ownership</b>													
General Overhead	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	3.19
Land Rent												31.02	31.02
Management Fee	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	6.60
Property Taxes (Machinery)				1.38							1.38		2.77
Property Insurance								0.99					0.99
<b>Cash Ownership Costs</b>	<b>0.82</b>	<b>0.82</b>	<b>0.82</b>	<b>2.20</b>	<b>0.82</b>	<b>0.82</b>	<b>0.82</b>	<b>1.80</b>	<b>0.82</b>	<b>2.20</b>	<b>0.82</b>	<b>31.84</b>	<b>44.56</b>
<b>Total Cash Costs/acre</b>	<b>15.84</b>	<b>1.97</b>	<b>1.97</b>	<b>3.37</b>	<b>1.99</b>	<b>2.00</b>	<b>2.01</b>	<b>50.27</b>	<b>2.40</b>	<b>3.80</b>	<b>2.42</b>	<b>42.69</b>	<b>130.72</b>

**Appendix Table 3a: Machinery and equipment costs per hour.**

Description	Purchase Price	Years to Trade	Salvage Value	Hours Used	<-Non-Cash->	<----Cash----->		<-----Operating----->			Total Costs/Hr.
					Ownership Cap. Rec.	Insur.	Taxes	Repairs	Fuel & Lube	Total Oper.	
Chisel Plow - 23'	16000	15	1536	60	27.63	0.59	1.65	2.74	0.00	2.74	32.61
Cr. Tractor-170hp	75000	15	14601	350	21.49	0.51	1.43	0.73	10.21	10.94	34.37
Cultivator - 40'	21600	15	2074	149	14.86	0.32	0.89	7.68	0.00	7.68	23.74
Fert. Spreader	1000	15	96	75	1.37	0.03	0.08	0.47	0.00	0.47	1.96
Grain Drill - 36'	35700	12	4945	100	39.99	0.81	2.27	8.98	0.00	8.98	52.04
Hill Combine 2-25'	243000	10	45837	200	146.49	2.88	8.08	13.93	12.61	26.54	183.99
Pickup 1 - 3/4 ton	30000	8	10470	400	9.42	0.20	0.57	3.44	4.31	7.75	17.94
Pickup 2 - 3/4 ton	7000	8	2443	400	2.20	0.05	0.13	0.80	5.39	6.19	8.57
Spike Harrow - 60'	2400	15	230	20	12.21	0.26	0.73	0.17	0.00	0.17	13.37
Tractor - 300hp	122000	15	23751	500	24.45	0.58	1.63	1.70	18.02	19.72	46.38
Truck 1 - 2 ton	28000	15	5451	125	22.40	0.53	1.49	3.22	5.75	8.97	33.41
Truck 2 - 2 ton	28000	15	5451	125	22.40	0.53	1.49	3.22	5.75	8.97	33.41

**Appendix Table 4a: Ranging analysis for production of yellow mustard seed.**

		Net Returns Per Acre Above Operating Costs For Mustard Seed						
		Yield (lb/acre)						
		770	880	990	1100	1210	1320	1430
Price (dollars/lb)	0.08	-24	-15	-7	2	10	19	27
	0.10	-8	2	13	24	35	45	56
	0.11	-1	11	23	35	47	59	70
	0.12	7	20	33	46	59	72	85
	0.13	15	29	43	57	71	85	99
	0.14	22	38	53	68	83	98	113
	0.16	38	55	72	90	107	125	142

		Net Returns Per Acre Above Cash Costs For Mustard Seed						
		Yield (lb/acre)						
		770	880	990	1100	1210	1320	1430
Price (dollars/lb)	0.08	-68	-60	-51	-43	-34	-26	-17
	0.10	-53	-42	-31	-21	-10	1	11
	0.11	-45	-33	-22	-10	2	14	26
	0.12	-37	-25	-12	1	14	27	40
	0.13	-30	-16	-2	12	26	40	54
	0.14	-22	-7	8	23	38	54	69
	0.16	-7	11	28	45	63	80	97

		Net Returns Per Acre Above Total Costs For Mustard Seed						
		Yield (lb/acre)						
		770	880	990	1100	1210	1320	1430
Price (dollars/lb)	0.08	-114	-106	-98	-89	-81	-73	-65
	0.10	-99	-88	-78	-67	-57	-47	-36
	0.11	-91	-79	-68	-56	-45	-33	-22
	0.12	-83	-71	-58	-45	-33	-20	-8
	0.13	-76	-62	-48	-34	-21	-7	7
	0.14	-68	-53	-38	-23	-9	6	21
	0.16	-52	-35	-18	-1	16	33	50

**Appendix Table 1b: Costs and returns per acre to produce soft white winter wheat.**

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Wheat	75.00	bu	3.75	281.25	
Total Gross Returns For Wheat				281.25	
Operating Costs					
Fertilizer:					
Nitrogen	120.00	lb	0.21	25.20	
Phosphate	20.00	lb	0.25	5.00	
Sulfur	20.00	lb	0.18	3.60	
Seed:					
Wheat Seed	80.00	lb	0.14	11.20	
Custom:					
Sprayer	1.00	acre	1.50	1.50	
Pesticide:					
Bronate 2lb Ai	0.50	qt	12.90	6.45	
Harmony Extra	0.33	oz	13.75	4.54	
Other:					
Crop Insurance	1.00	acre	2.81	2.81	
Labor (machine)	1.54	hrs	13.30	20.46	
Labor (non-machine)	0.31	hrs	8.20	2.54	
Fuel - Gas	2.33	gal	1.50	3.50	
Fuel - Diesel	7.09	gal	0.90	6.38	
Lube				1.48	
Machinery repair				6.67	
Interest on operating capital @ 9.75%				7.00	
Total Operating Costs/acre				108.33	
Net Returns Above Operating Costs				172.92	
Cash Ownership Costs					
General Overhead				5.00	
Land Rent				75.00	
Management Fee				14.00	
Property Taxes (Machinery)				2.88	
Property Insurance				1.03	
Total Cash Ownership Costs/acre				97.91	
Non-Cash Ownership Costs (Depreciation and Interest)					
Equipment				49.03	
Total Non-Cash Ownership Costs/acre				49.03	
Total Costs/acre				255.27	
Returns to Risk				25.98	

**Appendix Table 2b: Monthly summary of cash expenses per acre for soft white winter wheat.**

	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Mar 98	Apr 98	May 98	Jun 98	Jul 98	Aug 98	Total
<b>Preharvest:</b>													
Cultivate	3.99												3.99
Fertilize	36.05												36.05
Seed Hauling	2.08												2.08
Plant	14.37												14.37
Ground Spray								15.03					15.03
Crop Insurance								2.81					2.81
General Farm Truck Use	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	12.23
<b>Total Preharvest Costs</b>	<b>57.50</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>18.86</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>86.56</b>
<b>Harvest:</b>													
Combine												10.62	10.62
Crop Hauling												4.15	4.15
<b>Total Harvest Costs</b>												<b>14.78</b>	<b>14.78</b>
Interest on Operating Capital	0.47	0.48	0.48	0.49	0.50	0.51	0.52	0.67	0.68	0.69	0.69	0.82	7.00
<b>Operating Costs/acre</b>	<b>57.97</b>	<b>1.49</b>	<b>1.50</b>	<b>1.51</b>	<b>1.52</b>	<b>1.53</b>	<b>1.54</b>	<b>19.53</b>	<b>1.70</b>	<b>1.71</b>	<b>1.71</b>	<b>16.62</b>	<b>108.33</b>
<b>Cash Ownership</b>													
General Overhead	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.00
Land Rent							75.00						75.00
Management Fee	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	14.00
Property Taxes (Machinery)				1.44						1.44			2.88
Property Insurance								1.03					1.03
<b>Cash Ownership Costs</b>	<b>1.58</b>	<b>1.58</b>	<b>1.58</b>	<b>3.02</b>	<b>1.58</b>	<b>1.58</b>	<b>76.58</b>	<b>2.61</b>	<b>1.58</b>	<b>3.02</b>	<b>1.58</b>	<b>1.58</b>	<b>97.91</b>
<b>Total Cash Costs/acre</b>	<b>59.55</b>	<b>3.08</b>	<b>3.09</b>	<b>4.54</b>	<b>3.10</b>	<b>3.11</b>	<b>78.12</b>	<b>22.15</b>	<b>3.28</b>	<b>4.73</b>	<b>3.30</b>	<b>18.20</b>	<b>206.25</b>

**Appendix Table 3b: Machinery and equipment costs per hour for soft white winter wheat.**

Description	Purchase Price	Years to Trade	Salvage Value	Hours Used	<-Non-Cash->		<-----Cash----->		<-----Operating----->		Total Oper.	Total Costs/Hr.
					Ownership Cap. Rec.	Insur.	Ownership Taxes	Repairs	Fuel & Lube			
Cr. Tractor-170hp	75000	15	14601	350	21.48	0.51	1.43	0.73	10.21	10.94	34.36	
Cultivator 2 - 40'	21600	15	2074	150	14.80	0.32	0.88	7.68	0.00	7.68	23.68	
Fert. Spreader	1000	15	96	75	1.38	0.03	0.08	0.47	0.00	0.47	1.96	
Grain Drill 2 -36'	42300	12	5859	100	47.47	0.96	2.70	10.63	0.00	10.63	61.76	
Hill Combine 2-22'	243000	10	45837	200	147.09	2.90	8.11	13.93	12.61	26.54	184.63	
Pickup 1 - 3/4 ton	30000	8	10470	400	9.41	0.20	0.57	3.44	4.31	7.75	17.93	
Pickup 2 - 3/4 ton	7000	8	2443	400	2.20	0.05	0.13	0.80	5.39	6.19	8.56	
Tractor - 300hp	122000	15	23751	500	24.47	0.58	1.63	1.70	18.02	19.72	46.41	
Truck 1 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54	
Truck 2 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54	
Truck 3 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54	

**Appendix Table 4b: Ranging analysis for production of soft white winter wheat.**

		Net Returns Per Acre Above Operating Costs For Wheat						
		Yield (bu/acre)						
		52.50	60.00	67.50	75.00	82.50	90.00	97.50
Price (dollars/bu)	2.63	33	52	70	89	107	126	145
	3.00	53	74	95	117	138	159	181
	3.38	73	97	121	145	169	194	218
	3.75	92	119	146	173	200	227	254
	4.13	112	142	172	201	231	261	291
	4.50	131	164	197	229	262	294	327
	4.88	151	187	222	258	293	329	364

		Net Returns Per Acre Above Cash Costs For Wheat						
		Yield (bu/acre)						
		52.50	60.00	67.50	75.00	82.50	90.00	97.50
Price (dollars/bu)	2.63	-64	-46	-27	-9	9	28	46
	3.00	-45	-24	-2	19	40	61	82
	3.38	-25	-1	23	47	71	95	119
	3.75	-5	21	48	75	102	129	156
	4.13	14	44	74	104	133	163	193
	4.50	34	66	99	131	164	196	229
	4.88	54	89	124	160	195	230	266

		Net Returns Per Acre Above Total Costs For Wheat						
		Yield (bu/acre)						
		52.50	60.00	67.50	75.00	82.50	90.00	97.50
Price (dollars/bu)	2.63	-108	-91	-75	-58	-41	-24	-7
	3.00	-88	-69	-50	-30	-11	9	29
	3.38	-68	-46	-24	-2	21	43	66
	3.75	-49	-24	1	26	51	77	102
	4.13	-29	-1	26	54	83	111	139
	4.50	-10	21	51	82	113	144	175
	4.88	10	44	77	111	145	178	212

**Appendix Table 1c: Costs and returns per acre to produce spring feed barley.**

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Barley	1.50	ton	98.00	147.00	
Total Gross Returns For Barley				147.00	
Operating Costs					
Pesticide:					
Far-Go	1.25	qt	10.85	13.56	
Bronate 2lb Ai	0.75	qt	12.90	9.68	
Fertilizer:					
Nitrogen	75.00	lb	0.21	15.75	
Sulfur	15.00	lb	0.18	2.70	
Seed:					
Barley Seed	80.00	lb	0.16	12.80	
Custom:					
Sprayer	1.00	acre	1.50	1.50	
Other:					
Crop Insurance	1.00	acre	2.26	2.26	
Labor (machine)	1.71	hrs	13.30	22.77	
Labor (non-machine)	0.19	hrs	8.20	1.56	
Fuel - Gas	2.06	gal	1.50	3.08	
Fuel - Diesel	10.97	gal	0.90	9.87	
Lube				1.94	
Machinery repair				8.04	
Interest on operating capital @ 9.75%				4.58	
Total Operating Costs/acre				110.09	
Net Returns Above Operating Costs				36.91	
Cash Ownership Costs					
General Overhead				3.80	
Land Rent				31.00	
Management Fee				7.35	
Property Taxes (Machinery)				3.42	
Property Insurance				1.22	
Total Cash Ownership Costs/acre				46.80	
Non-Cash Ownership Costs (Depreciation and Interest)					
Equipment				57.62	
Total Non-Cash Ownership Costs/acre				57.62	
Total Costs/acre				214.51	
Returns to Risk				-67.51	

**Appendix Table 2c: Monthly summary of cash expenses per acre for spring feed barley.**

	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Mar 98	Apr 98	May 98	Jun 98	Jul 98	Aug 98	Total
<b>Preharvest:</b>													
Plow	9.15												9.15
Cultivate								18.26					18.26
Fertilize								20.13					20.13
Seed Hauling								2.08					2.08
Plant								15.97					15.97
Ground Spray								13.72					13.72
Crop Insurance								2.26					2.26
General Farm Truck Use	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	12.23
<b>Total Preharvest Costs</b>	<b>10.17</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>73.43</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>93.79</b>
<b>Harvest:</b>													
Combine												9.64	9.64
Crop Hauling												2.08	2.08
<b>Total Harvest Costs</b>												<b>11.72</b>	<b>11.72</b>
Interest on Operating Capital	0.08	0.09	0.10	0.11	0.12	0.12	0.13	0.73	0.74	0.75	0.75	0.86	4.58
<b>Operating Costs/acre</b>	<b>10.26</b>	<b>1.11</b>	<b>1.12</b>	<b>1.13</b>	<b>1.13</b>	<b>1.14</b>	<b>1.15</b>	<b>74.16</b>	<b>1.76</b>	<b>1.76</b>	<b>1.77</b>	<b>13.59</b>	<b>110.09</b>
<b>Cash Ownership</b>													
General Overhead	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	3.80
Land Rent							31.00						31.00
Management Fee	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	7.35
Property Taxes (Machinery)				1.71						1.71			3.42
Property Insurance								1.22					1.22
<b>Cash Ownership Costs</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>2.64</b>	<b>0.93</b>	<b>0.93</b>	<b>31.93</b>	<b>2.15</b>	<b>0.93</b>	<b>2.64</b>	<b>0.93</b>	<b>0.93</b>	<b>46.80</b>
<b>Total Cash Costs/acre</b>	<b>11.18</b>	<b>2.04</b>	<b>2.05</b>	<b>3.77</b>	<b>2.06</b>	<b>2.07</b>	<b>33.08</b>	<b>76.31</b>	<b>2.69</b>	<b>4.41</b>	<b>2.70</b>	<b>14.52</b>	<b>156.88</b>

**Appendix Table 3c: Machinery and equipment costs per hour.**

Description	Purchase Price	Years to Trade	Salvage Value	Hours Used	<-Non-Cash->	<-----Cash----->		<-----Operating----->			Total Costs/Hr.
					Ownership Cap. Rec.	Ownership Insur.	Taxes	Repairs	Fuel & Lube	Total Oper.	
Cr. Tractor-170hp	75000	15	14601	350	21.51	0.51	1.44	0.73	10.21	10.94	34.40
Cultivator 2 - 40'	21600	15	2074	150	14.85	0.32	0.89	7.68	0.00	7.68	23.73
Fert. Spreader	1000	15	96	75	1.38	0.03	0.08	0.47	0.00	0.47	1.96
Grain Drill 2 -36'	42300	12	5859	100	47.47	0.96	2.70	10.63	0.00	10.63	61.76
Hill Combine 2-22'	243000	10	45837	200	147.09	2.90	8.11	13.93	12.61	26.54	184.63
Moldboard Plow 8b	19200	15	1843	110	18.02	0.38	1.08	5.33	0.00	5.33	24.81
Pickup 1 - 3/4 ton	30000	8	10470	400	9.41	0.20	0.57	3.44	4.31	7.75	17.93
Pickup 2 - 3/4 ton	7000	8	2443	400	2.20	0.05	0.13	0.80	5.39	6.19	8.56
Sprayer - 40'	3500	15	336	30	12.19	0.26	0.73	0.42	0.00	0.42	13.60
Tractor - 300hp	122000	15	23751	500	24.48	0.58	1.63	1.70	18.02	19.72	46.41
Truck 1 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54
Truck 2 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54

**Appendix Table 4c: Ranging analysis for production of spring feed barley.**

		Net Returns Per Acre Above Operating Costs For Barley						
		Yield (ton/acre)						
		1.05	1.20	1.35	1.50	1.65	1.80	1.95
Price (dollars/ton)	68.60	-35	-26	-17	-7	2	11	21
	78.40	-25	-14	-3	8	18	29	40
	88.20	-15	-2	10	22	34	47	59
	98.00	-4	9	23	37	51	64	78
	107.80	6	21	36	52	67	82	97
	117.60	16	33	50	66	83	100	116
	127.40	27	45	63	81	99	117	135

		Net Returns Per Acre Above Cash Costs For Barley						
		Yield (ton/acre)						
		1.05	1.20	1.35	1.50	1.65	1.80	1.95
Price (dollars/ton)	68.60	-82	-72	-63	-54	-45	-36	-26
	78.40	-71	-61	-50	-39	-29	-18	-7
	88.20	-61	-49	-37	-25	-12	-0	12
	98.00	-51	-37	-24	-10	4	17	31
	107.80	-40	-25	-10	5	20	35	50
	117.60	-30	-14	3	20	36	53	69
	127.40	-20	-2	16	34	52	70	88

		Net Returns Per Acre Above Total Costs For Barley						
		Yield (ton/acre)						
		1.05	1.20	1.35	1.50	1.65	1.80	1.95
Price (dollars/ton)	68.60	-134	-127	-119	-112	-104	-96	-88
	78.40	-124	-115	-106	-97	-88	-78	-69
	88.20	-114	-103	-93	-82	-71	-61	-50
	98.00	-103	-92	-80	-68	-55	-43	-30
	107.80	-93	-80	-66	-53	-39	-25	-11
	117.60	-83	-68	-53	-38	-23	-8	8
	127.40	-72	-56	-40	-23	-7	10	27



**Appendix Table 1d: Costs and returns per acre to produce lentils.**

	Quantity Per Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
Gross Returns					
Lentils	13.00	cwt	15.40	200.20	
Total Gross Returns For Lentils				<u>200.20</u>	
Operating Costs					
Custom:					
Sprayer	2.00	acre	1.50	3.00	
Pesticide:					
Far-Go	1.25	qt	10.85	13.56	
Sencor DF	0.50	lb	23.15	11.57	
Seed:					
Lentil Seed	75.00	lb	0.18	13.50	
Other:					
Crop Insurance	1.00	acre	6.69	6.69	
Labor (machine)	2.03	hrs	13.30	26.95	
Labor (non-machine)	0.27	hrs	8.20	2.21	
Fuel - Gas	2.06	gal	1.50	3.09	
Fuel - Diesel	11.84	gal	0.90	10.65	
Lube				2.06	
Machinery repair				7.73	
Interest on operating capital @ 9.75%				3.86	
Total Operating Costs/acre				<u>104.87</u>	
Net Returns Above Operating Costs				95.33	
Cash Ownership Costs					
General Overhead				4.00	
Land Rent				40.00	
Management Fee				10.00	
Property Taxes (Machinery)				4.22	
Property Insurance				1.51	
Total Cash Ownership Costs/acre				<u>59.73</u>	
Non-Cash Ownership Costs (Depreciation and Interest)					
Equipment				72.04	
Total Non-Cash Ownership Costs/acre				<u>72.04</u>	
Total Costs/acre				236.64	
Returns to Risk				-36.44	

**Appendix Table 2d: Monthly summary of cash expenses per acre for lentils.**

	Sep 97	Oct 97	Nov 97	Dec 97	Jan 98	Feb 98	Mar 98	Apr 98	May 98	Jun 98	Jul 98	Aug 98	Total
<b>Preharvest:</b>													
Plow	3.49												3.49
Cultivate								24.84					24.84
Seed Hauling								2.08					2.08
Plant								16.67					16.67
Roll								5.63					5.63
Harrow								3.66					3.66
Crop Insurance								6.69					6.69
Ground Spray									9.83				9.83
General Farm Truck Use	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	12.24
<b>Total Preharvest Costs</b>	<b>4.51</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>60.58</b>	<b>10.86</b>	<b>1.02</b>	<b>1.02</b>	<b>1.02</b>	<b>85.13</b>
<b>Harvest:</b>													
Swath												3.51	3.51
Combine												10.30	10.30
Crop Hauling												2.08	2.08
<b>Total Harvest Costs</b>												<b>15.88</b>	<b>15.88</b>
Interest on Operating Capital	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.58	0.67	0.68	0.68	0.82	3.86
<b>Operating Costs/acre</b>	<b>4.55</b>	<b>1.07</b>	<b>1.07</b>	<b>1.08</b>	<b>1.09</b>	<b>1.10</b>	<b>1.11</b>	<b>61.16</b>	<b>11.52</b>	<b>1.70</b>	<b>1.70</b>	<b>17.73</b>	<b>104.87</b>
<b>Cash Ownership</b>													
General Overhead	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	4.00
Land Rent							40.00						40.00
Management Fee	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	10.00
Property Taxes (Machinery)				2.11						2.11			4.22
Property Insurance								1.51					1.51
<b>Cash Ownership Costs</b>	<b>1.17</b>	<b>1.17</b>	<b>1.17</b>	<b>3.28</b>	<b>1.17</b>	<b>1.17</b>	<b>41.17</b>	<b>2.68</b>	<b>1.17</b>	<b>3.28</b>	<b>1.17</b>	<b>1.17</b>	<b>59.73</b>
<b>Total Cash Costs/acre</b>	<b>5.72</b>	<b>2.23</b>	<b>2.24</b>	<b>4.36</b>	<b>2.26</b>	<b>2.27</b>	<b>42.27</b>	<b>63.84</b>	<b>12.69</b>	<b>4.97</b>	<b>2.87</b>	<b>18.89</b>	<b>164.61</b>

**Appendix Table 3d: Machinery and equipment costs per acre for lentils.**

Description	Purchase Price	to Trade	Salvage Value	Hours Used	<-Non-Cash->	<-----Cash----->		<-----Operating----->			Total Costs/Hr.
					Ownership Cap. Rec.	Ownership Insur.	Taxes	Repairs	Fuel & Lube	Total Oper.	
Chisel Plow - 21'	12350	15	1185	60	21.15	0.45	1.26	2.11	0.00	2.11	24.98
Cr. Tractor-170hp	75000	15	14601	350	21.49	0.51	1.43	0.73	10.21	10.94	34.37
Cultivator 2 - 40'	21600	15	2074	150	14.80	0.32	0.88	7.68	0.00	7.68	23.68
Grain Drill 2 -36'	42300	12	5859	100	47.47	0.96	2.70	10.63	0.00	10.63	61.76
Hill Combine 2-22'	243000	10	45837	200	147.09	2.90	8.11	13.93	12.61	26.54	184.63
Pickup 1 - 3/4 ton	30000	8	10470	400	9.43	0.20	0.57	3.44	4.31	7.75	17.95
Pickup 2 - 3/4 ton	7000	8	2443	400	2.20	0.05	0.13	0.80	5.39	6.19	8.57
Roller - 15'	6000	20	313	75	7.46	0.17	0.47	1.42	0.00	1.42	9.52
SP Swather - 12'	59800	10	10575	100	72.91	1.41	3.96	2.42	0.00	2.42	80.71
Spike Harrow 2-20'	800	15	77	50	1.66	0.04	0.10	0.12	0.00	0.12	1.92
Tractor - 300hp	122000	15	23751	500	24.47	0.58	1.63	1.70	18.02	19.72	46.40
Truck 1 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54
Truck 2 - 2 ton	28000	15	5451	125	22.53	0.54	1.50	3.22	5.75	8.97	33.54

**Appendix Table 4d: Ranging analysis for production of lentils.**

		Net Returns Per Acre Above Operating Costs For Lentils						
		Yield (cwt/acre)						
		9.10	10.40	11.70	13.00	14.30	15.60	16.90
Price (dollars/cwt)	10.78	-3	10	23	35	48	61	73
	12.32	11	26	41	55	70	85	99
	13.86	25	42	59	75	92	109	125
	15.40	39	58	77	95	114	133	151
	16.94	53	74	95	115	136	157	177
	18.48	67	90	113	135	158	181	204
	20.02	81	106	131	155	180	205	230

		Net Returns Per Acre Above Cash Costs For Lentils						
		Yield (cwt/acre)						
		9.10	10.40	11.70	13.00	14.30	15.60	16.90
Price (dollars/cwt)	10.78	-62	-50	-37	-24	-12	1	13
	12.32	-48	-34	-19	-4	10	25	39
	13.86	-34	-18	-1	16	32	49	65
	15.40	-20	-2	17	36	54	73	91
	16.94	-6	14	35	56	76	97	117
	18.48	8	30	53	76	98	121	143
	20.02	22	46	71	96	120	145	170

		Net Returns Per Acre Above Total Costs For Lentils						
		Yield (cwt/acre)						
		9.10	10.40	11.70	13.00	14.30	15.60	16.90
Price (dollars/cwt)	10.78	-129	-118	-108	-97	-85	-74	-63
	12.32	-115	-102	-89	-76	-63	-50	-37
	13.86	-101	-86	-71	-56	-41	-26	-11
	15.40	-87	-70	-53	-36	-19	-2	15
	16.94	-73	-54	-35	-16	3	22	41
	18.48	-59	-38	-17	4	25	46	67
	20.02	-45	-22	1	24	47	70	93

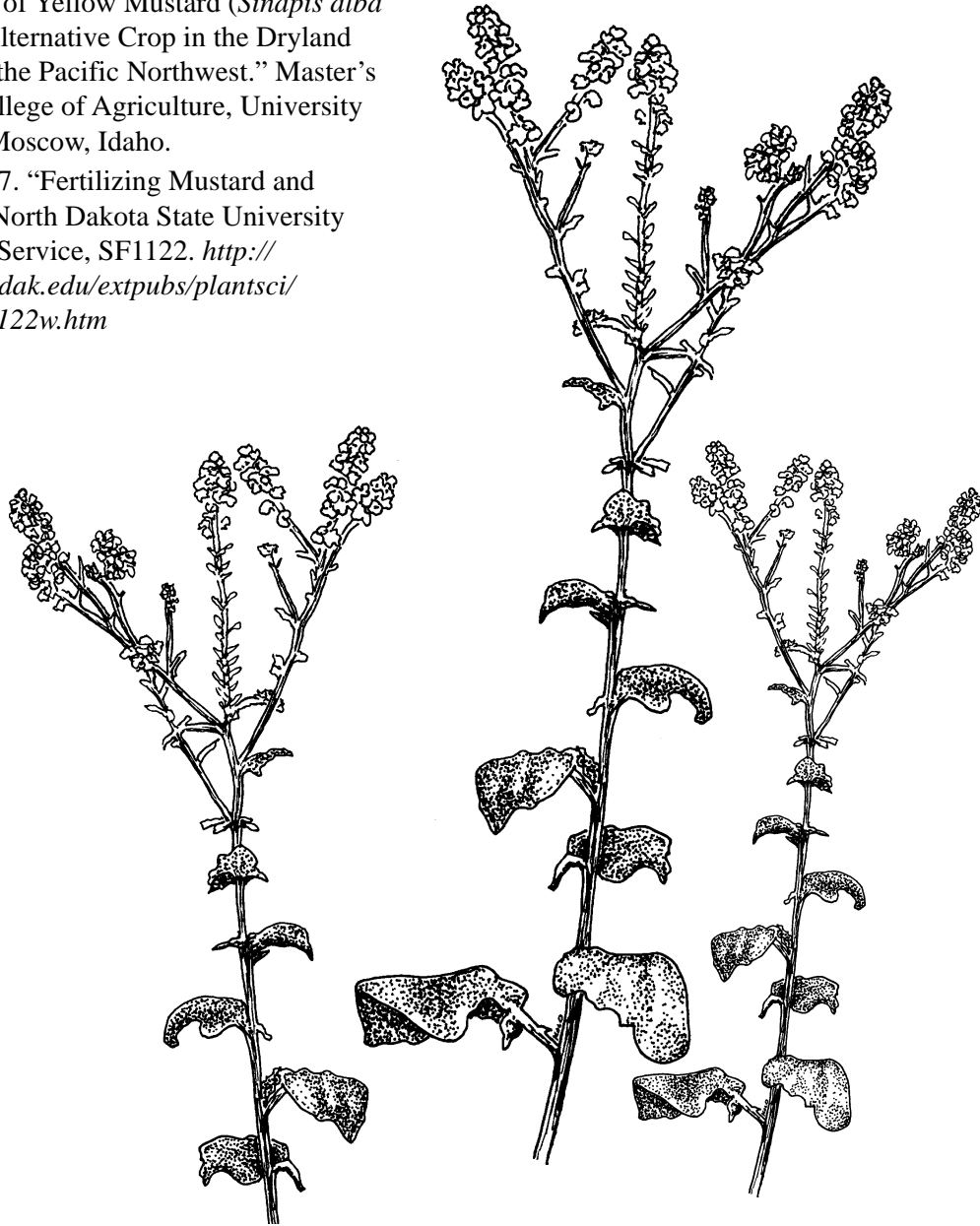
The practices and chemicals specified here are based on survey information representative of typical operations. They are not recommendations. Because of constantly changing labels, laws, and regulations, the University of Idaho can assume no liability for the consequences of use of chemicals specified here. In all cases, read and follow the directions and precautionary statements on the specific pesticide product label. To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

## Further Reading

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