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TRITICALE —

a potential crop for the Pacific Northwest:

an economic study

G. Belcher
R. Withers

Agricultural Experiment Station
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The Authors

Gary Belcher is a former research associate and R. V. Withers is professor of agricultural economics, both in the Department of Agricultural Economics and Applied Statistics, University of Idaho, Moscow.

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Introduction

Pacific Northwest dryland farmers in recent years have been interested in new crops that can be rotated into traditional crop schemes. The traditional crops — soft white wheat, barley, dry peas and lentils — are perhaps best suited to the area. In the past, though, dependence on only a few crops has led to overproduction and hence lower prices.

A good, feed grain crop is desirable in the Pacific Northwest (PNW) to lessen the need for high protein supplements purchased from outside the region. Crops which would qualify as replacements for wheat and barley in set-aside programs are also needed. Some potential also exists for both a high protein, human, food grain and a feed grain that can be exported overseas.

Triticale (pronounced trit-e-kay-lee) is a feed and food grain which may be a profitable alternative if various marketing and agronomic problems can be solved. Many researchers and industry people feel the main problem currently is in marketing rather than in production. Acceptance of the grain among growers, users and middlemen has ranged from enthusiasm to pessimism and complete lack of interest. This publication deals with marketing problems and potential of triticale, with the main focus on the PNW.

TRITICALE — A Potential Crop for the Pacific Northwest: *An Economic Study*

Gary Belcher and R. V. Withers

Triticale was a result of both scientific plant breeding and random luck. A hybrid of wheat (genus triticum) and rye (genus secale), triticale was first reported in 1876. A. S. Wilson in Scotland successfully crossed wheat and rye, but the resulting offspring was sterile.

P. Givandon, a French scientist, made the next major breakthrough in 1937 chemically treating seedlings which increased chromosome levels and created a fertile plant. According to Hulse and Spurgeon (8), "This discovery opened the door for the metamorphosis of triticale from a laboratory curiosity into a potential food crop."

The modern phase of interest in triticale started in 1954 when the University of Manitoba began a strongly financed research program. Triticale varieties were collected from all over the world and interbred. To broaden the scope of the breeding program, the university started a joint project with the International Maize and Wheat Improvement Center (CIMMYT) in Mexico in 1963.

An accidental crossing of a CIMMYT wheat and triticale resulted in a new strain — Armadillo — which yielded 50 to 60 percent higher than previous triticales. Rossi (15) stated, "Zillinsky and Borlaug in 1971 pointed out the following significant traits of the Armadillo strains which represent the major breakthrough in triticale improvement work: very high level of fertility, improved kernel characteristics and test weight, high yielding ability, photo-insensitivity, presence of one gene for dwarfness and high nutritional quality."

According to Hulse and Spurgeon (8), "Between 1967 and 1973, workers in Mexico and Manitoba succeeded in virtually redesigning the triticale plant genetically, so that most of its initial biological faults have been corrected."

Currently, research is being carried on in many locations — the University of Idaho, Washington State University, Oregon State University, the University of Manitoba, CIMMYT and the Jenkins Research Foundation in Salinas, California. Research goals for the PNW are to determine adaptability to the climate in fall-seeded varieties and to discover varieties that will consistently outyield winter barley (19).

One line, Palouse (6TA476), released from the Jenkins Foundation has been tested extensively by USDA and Washington State University, and new funding has allowed the foundation to resume triticale research.

The University of Manitoba since 1955 has been actively engaged in triticale breeding and development. The University licensed and released a third variety in the spring of 1980.

Zillinsky and Borlaug are continuing triticale research at CIMMYT. Studies are viewing spring types that have general daylight insensitivity more suited to the lower latitudes. The goal of the CIMMYT triticale project, according to Hulse and Evangeline (7), is to "benefit people in less developed countries, particularly those who are below, or close to, the margin of dietary calorie and protein sufficiency."

The interest in triticale, as reported by Chrispeels and Sadava (2), stems from the desire to combine wheat's high yield and high seed protein content with rye's adaptability to adverse environmental conditions, such as cold and drought, and high seed lysine content. Rye is "poor man's wheat." It is grown in arid sandy soils and under climatic conditions which wheat will not tolerate.

A huge number of possible triticale varieties exists, given 6,000 varieties of wheat and 2,000 of rye. As Hulse and Spurgeon (8) stated, "It should be emphasized that triticale is not a single plant species — triticale is a genus, and, like wheat and rye, it has many cultivars of widely different characteristics. When one reads reports that triticale has certain properties or problems, one should keep in mind that the report is probably dealing only with one specific type of triticale grown under one set of environmental conditions."

Triticale Production In Idaho and Washington, 1975-76

Interest in alternative crops in the PNW grew in 1975 because of relatively low wheat prices. A Texas firm promoted triticale in eastern and central Washington and in northern Idaho. About 8,000 acres were contracted in Washington and 500 acres in northern Idaho. At the end of the season, however, the firm went bankrupt and did not honor its contracts with growers. Regional grain elevators who were agents for both the company and growers shared in the loss. The triticale involved finally sold for prices comparable to feed barley.

The experience left many of the involved elevator people and growers embittered. F. J. Zillinsky of CIMMYT stated, "Most farmers have become acquainted with triticale through seed promoters who have done little but produce some seed and sell it to whomever they could con into buying it, mostly with bad results, and so triticale is the culprit."

Triticale in Montana

Triticale has been an important crop in Montana in the past. About 110,000 acres were planted in triticale in the 1978-79 crop year, apparently as a result of a program that year which restricted acreage of major grain crops, wheat and barley. Alternative crops, triticale, safflower, faba beans and others, were planted on the remaining acreage.

Triticale was promoted by a few seed dealers, although one observer termed it "overpromoted." It was mainly grown in the "triangle" wheat region above Great Falls. One observer reported that the triticale surge in 1978-79 was a "classic example of no market planning."

No one knew how or where to market the triticale. The predicted outlet for the triticale as flour did not develop during the postharvest marketing period. Most of the triticale went into feed channels and was discounted down to a feed barley price.

According to another observer, triticale is currently marketed like barley in Montana. He feels that triticale is a good crop under the wheat set-aside but that more money can be made in wheat and barley.

Production

U.S. production of triticale has been insignificant during the past decade. Interest has been greatest in the Plains States, Texas and the PNW. Fig. 1 shows areas of wheat production in the PNW that would also be adaptable to triticale. Table 1 gives national and PNW county production figures for 1974. Current figures are not available. Since triticale is a minor crop at present, statistics on production (or trade) are not kept in most of the usual statistical references, which also is a hinderance to research into the crop.[1]

Cultural practices for triticale are nearly identical to those for wheat and barley. A Troy, Idaho,

[1]Examples are the Idaho Agricultural Statistics Yearbook, USDA Foreign Agriculture Service data, UN Food and Agriculture Production and Trade Yearbooks, the USDA-ESCS U.S. Foreign Agricultural Trade Yearbook, or Department of Commerce Custom District Data.

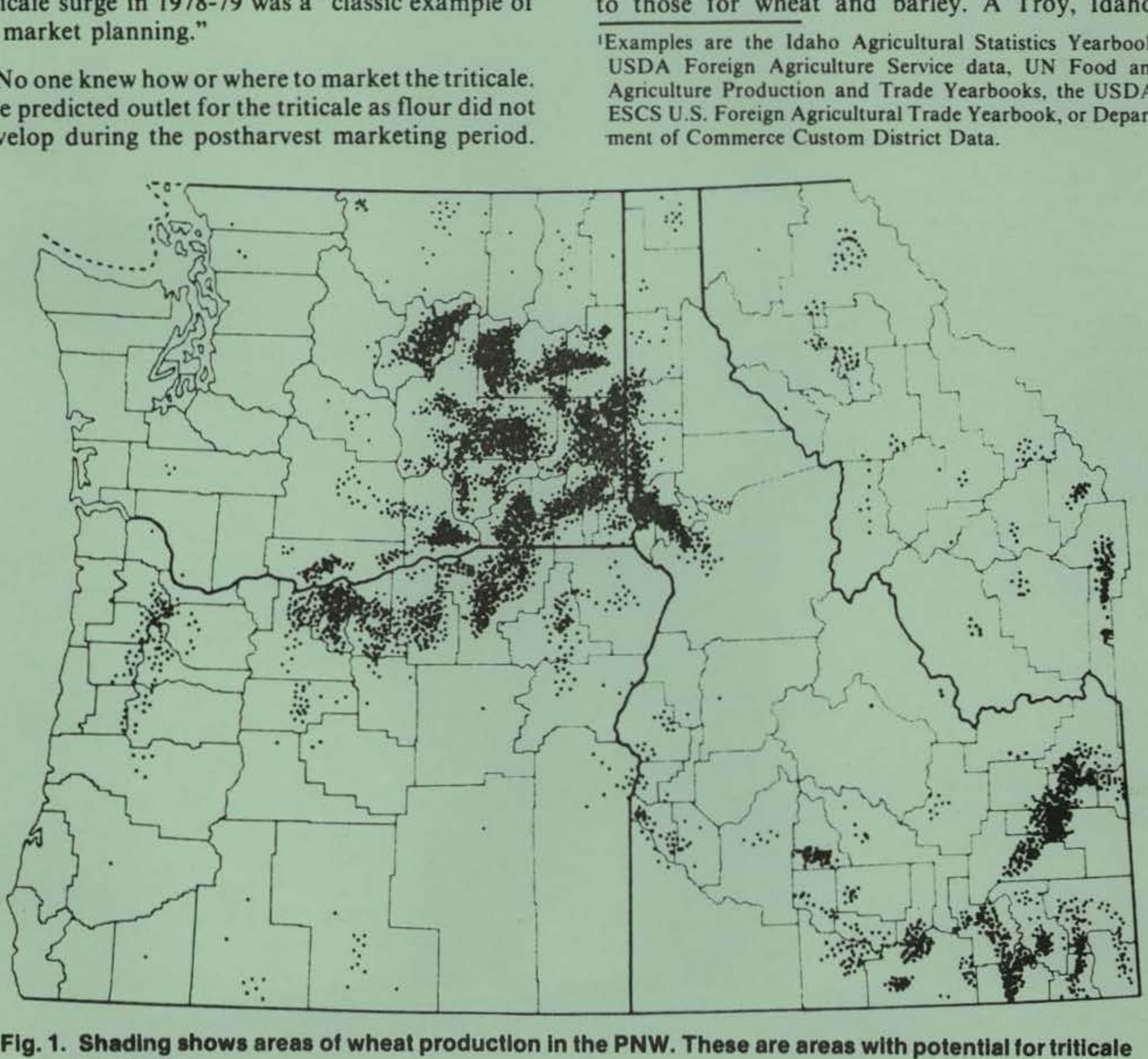

Fig. 1. Shading shows areas of wheat production in the PNW. These are areas with potential for triticale production.

Table 1. Nationwide and PNW countywide triticale production figures, 1974.

	Harvested			Irrigated	
	farms	acres	quantity	farms	acres
U.S., total	250	10,542	(X)	107	6,305
California	7	861	(X)	5	698
Colorado	6	322	(X)	5	157
Idaho	11	199	(X)	11	199
Illinois	8	143	(X)	-	-
Kansas	19	743	(X)	3	253
Maine	3	4	(X)	-	-
Michigan	3	16	(X)	-	-
Minnesota	4	27	(X)	-	-
Montana	5	214	(X)	1	(X)
Nebraska	6	45	(X)	-	-
New Mexico	9	568	(X)	6	455
North Dakota	10	488	(X)	-	-
Ohio	15	45	(X)	-	-
Oklahoma	15	466	(X)	1	(X)
Oregon	5	191	(X)	4	166
South Dakota	8	100	(X)	-	-
Texas	89	5,243	(X)	63	4,244
Utah	9	117	(X)	6	40
Wisconsin	6	38	(X)	-	-
All other	22	712	(X)	2	(X)
Idaho, total	11	199	(X)	11	199
Payette	4	97	(X)	4	97
All other	7	102	(X)	7	102
Montana, total	5	214	(X)	1	-
Carter	3	136	(X)	1	-
Oregon, total	5	191	(X)	4	166
Baker	3	160	(X)	3	160
Washington, total	(X)	(X)	(X)	(X)	(X)

Source: 17.

grower felt that triticale was a good crop — good on soil, easy to raise and easy to harvest. A Bonners Ferry, Idaho, grower reported production costs were the same as wheat.

Because production costs for triticale were not readily available, wheat budgets are presented in this report. Production costs for wheat, and presumably for triticale, are shown in Tables 2 and 3. These budgets are for Boundary County in 1980 and are essentially the same as budgets in other areas of northern Idaho. (17). Wheat yields did vary somewhat, but costs per acre were quite constant throughout the area. Both spring and winter wheat costs about $150 per acre to produce in addition to associated land costs.

Several advantages and disadvantages are attributed to triticale. One of its advantages is that it is deep-rooting. This means the roots absorb more nutrients so less commercial fertilizer is required. Also, the roots absorb more soil moisture which means that triticale is drought resistant. Better soil stability is still another result.

Triticale has a higher plant height than wheat or barley, however, which causes a susceptibility to lodging. Recent breeding efforts have focused on developing a shorter, stiff-strawed plant.

Ergot has been a major problem with triticale in the past, especially in the northern latitudes. Much of the problem was with the older, sterile lines of triticale which do not have the full seed development that inhibits ergot. As the fertility of the varieties increases (as the head fills in more), the ergot problem decreases.

Triticale is not well suited to PNW grass seed producing areas, such as the Rathdrum prairie in northern Idaho. E. N. Larter at the University of Manitoba stated, "Ergot is a problem that varies according to weather conditions. Current triticale varieties grown in western Canada are no more susceptible to ergot that wheat. However, just as with wheat, cool wet weather during the plowing period will increase the incidence of ergot. Nevertheless, the level of infection by this disease has decreased over the years as a result of our breeding for earlier maturing varieties with higher fertility. Ergot is certainly no longer the deterrent to triticale production as it was a few years ago."

Table 2. Winter wheat production costs per acre on 225 acres of wheat in Boundary County, Idaho in 1980.

	Unit	Price or cost/unit	Quantity per acre	Value or cost per acre
Production per acre	bu		66.00	
Variable costs — Preharvest				
Wheat seed	lb	0.10	102.00	$ 10.20
Anhydrous ammonia	lb	0.19	47.50	9.02
Apply fertilizer	acre	3.10	1.00	3.10
16-20-0	lb	0.11	150.00	16.50
Air spray	acre	3.75	1.00	3.75
Carbyne	qt	4.50	1.00	4.50
2,4-D	qt	3.13	0.75	2.35
Machinery	acre	4.60	1.00	4.60
Tractors	acre	10.56	1.00	10.56
Labor (tractor and machinery)	hour	4.25	1.22	5.20
Interest on operating capital	$	0.12	49.22	5.91
Subtotal, preharvest				$ 75.69
Variable costs — Harvest costs				
Machinery	acre	7.72	1.00	$ 7.72
Tractors	acre	5.15	1.00	5.15
Labor (tractor and machinery)	hour	4.25	0.92	3.89
Subtotal, harvest				$ 16.76
Total variable cost				$ 92.45
Fixed costs				
Machinery	acre	22.05	1.00	$ 22.05
Tractors	acre	11.68	1.00	11.68
Taxes (land, water)	acre	3.50	1.00	3.50
Overhead	acre	3.26	1.00	3.26
Total fixed costs				$ 40.50
Management	$	0.05	264.00	$ 13.20
Total costs per acre (except land investment)				$146.15

Source: 14.

Table 3. Spring wheat production costs per acre on 115 acres of wheat in Boundary County, Idaho in 1980.

	Unit	Price or cost/unit	Quantity per acre	Value or cost per acre
Production per acre	bu		46.50	
Variable costs — Preharvest				
Wheat seed	lb	0.10	103.00	$ 10.30
Urea	lb	0.12	80.00	9.60
Apply fertilizer	acre	3.10	1.00	3.10
16-20-0	lb	0.11	135.00	14.85
Carbyne	qt	4.50	0.50	2.25
2,4-D	qt	3.13	0.75	2.35
Air spray	acre	3.75	2.00	7.50
Machinery	acre	6.26	1.00	6.26
Tractors	acre	10.84	1.00	10.84
Labor (tractor and machinery)	hour	4.25	1.42	6.02
Interest on operating capital	$	0.12	19.62	2.35
Subtotal, preharvest				$ 75.41
Variable costs — Harvest costs				
Machinery	acre	7.72	1.00	$ 7.72
Tractors	acre	3.81	1.00	3.81
Labor (tractor and machinery)	hour	4.25	0.84	3.59
Subtotal, harvest				$ 15.12
Total variable cost				$ 90.52
Fixed costs				
Machinery	acre	25.96	1.00	$ 25.96
Tractors	acre	12.61	1.00	12.61
Taxes (land, water)	acre	3.50	1.00	3.50
Overhead	acre	3.29	1.00	3.29
Total fixed costs				$ 45.36
Management	$	0.05	186.00	$ 9.30
Total costs per acre (except land investment)				$145.19

Volunteering is another problem, or at least a perceived problem, in the PNW. Two plant breeders felt that volunteering was not much of a problem. For instance, triticale can be seen easily since it is taller than wheat, so volunteering may be perceived as a greater problem than it is. Also, the reverse of the problem could be equally true — wheat could volunteer in triticale. Volunteering caused by seed dormancy is being bred out. A mild winter can cause a volunteering problem — a harsh winter kills off volunteer plants. One researcher believes a triticale-to-lentils (or dry peas)-to-wheat rotation would overcome the volunteering problem.

Tables 4 and 5 show recent yields among different varieties of wheat, barley and triticale in eight Idaho locations and Pullman, Washington. Fall plantings are recorded in Table 4 and spring plantings in Table 5. Some of the spring varieties are tested as winter varieties also. Those which do well are thus suitable as fall varieties because of resistance to winter kill.[2]

A northern Idaho grower reported that triticale yielded 30 percent higher than barley in 1977 (at 3,750 lb/acre), although 1980 barley yielded 4,660 lb/acre. The comparison showed the Siskyou variety got 14.9 percent protein. Internationally, Yang (21) found that "the yields have increased generally to the point where the average yields of the best wheats and best triticales are equal across 100 to 200 locations around the world."

Triticale protein levels have actually decreased over the years. This has been caused by greater fertility in recent varieties — as fertility increases, protein decreases. Initial triticale varieties were highly sterile. But, according to B. C. Jenkins of the Jenkins Foundation for Research, "We don't talk about quantity without talking about quality." He added, "The protein quality in triticale is higher than it is in other grains because of a better balance of amino acids." At equal levels of protein quantity of wheat and triticale, Jenkins feels that triticale has better nutritive quality, considering its lysine content.

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[2]More exact yield information is forthcoming from the University of Idaho and Washington State University.

Table 4. Idaho and Pullman, Washington, crop yield comparisons on test plots for winter crops.

Variety	Moscow	Pullman, WA	Cavendish	Variety	Moscow	Pullman, Wa	Cavendish
			1978-79 winter crops* (short tons/acre)				
Wheat				**Triticale**			
Stephens	2.8	2.6		VT229	2.5	2.3	1.0
Nugaines	2.9	2.4	.9	Palouse	2.6	2.0	1.0
Daws		2.3		Beagle	1.9	1.2	.7
Luke		2.5		M778867	1.6		.9
Fielder				Rahum		1.2	
Dirkwin				Lince		1.4	
Weston	1.9			Myoy		2.5	
Karkoff	1.9			My13		2.7	
				VT76370		1.9	
Barley				FS1897		1.9	
Boyer	2.3	1.8		Mayaiarm		1.4	
Kamiak		1.1		MT76010		1.4	
Wintermalt	2.4						
Schyler	2.5						
Kamiak ORFB	2.2		1.0				

Table 4. Continued.

Variety	Moscow	Pullman, WA	Cavendish	Bonners Ferry	Rimrock	Tammany	Nezperce	Grangeville	Ruebens
				1979-80 winter crops (short tons/acre)					
Wheat									
Stephens		2.0		1.7					
Nugaines		1.5	.9	1.6	1.9	2.5	2.0	1.3	1.5
Daws		1.9		1.6					
Luke		1.9							
Barley									
Boyer		1.6	1.9	1.3	1.7	2.2	2.0	2.2	1.7
Kamiak		1.2	1.9	.5	1.8	2.0	1.9	2.4	1.9
Schyler			1.8	1.2	2.0	2.1	2.0	2.1	1.5
Triticale									
VT229		2.5	2.1	.9	1.9	2.7	2.3	2.7	.9
Palouse		2.5	2.5	1.3	2.3	2.8	2.3	2.8	.9
Beagle		1.9	1.9	.3	1.3	1.7	2.0	2.1	.8
M778867									
Rahum		1.3							
Lince		1.2		.3					
My07		2.4							
My13		2.2							
VT76370		2.4		.9					
FS1897		1.9							
Mayaiarm		1.9							
M76010		1.6							

*Idaho data courtesty of R. E. Ohms, Extension agronomist, University of Idaho; Washington data courtesy of Alan Ciha, research agronomist, USDA-SEA, Washington State University.

Zillinsky at CIMMYT reported, "Triticale's protein content has decreased with improvement in seed type and test weight. The average is now only slightly above bread wheat's while lysine content is considerably higher than wheat's."

Lysine is the most limiting amino acid in grains. Thus, the relatively high lysine content of triticale is important. As Hulse and Spurgeon (8) state, "The protein content of common wheats varies from 6 to 23 percent, with a mean average of 12.9 percent on a dry-weight basis. The protein content of rye is lower, ranging from 6.5 to 15 percent, but its biological value is higher, primarily because of its higher lysine content. In some cases, triticale combines the high total content of wheat and the high lysine content of rye."

Table 6 shows protein comparisons among wheats, barleys and triticales in field trials at Moscow and Bonners Ferry, Idaho. Table 7 gives a comparison of essential amino acid levels in selected crops including triticale. The amino acid levels are compared to Food and Agricultural Organization (FAO) ideal levels.

Interest in triticale is not limited to the U.S., and the grain is produced commercially in most areas of the world. Hulse and Spurgeon (8) estimated production woldwide in 1972 was 1,000,000 acres. Schultz (16) estimated 400,000 acres of triticale were planted in 1978. Officials of CIMMYT and the University of Manitoba provided the 1980 production figures, locations and comments cited in Table 8.

Table 5. Idaho and Pullman, Washington, crop yield comparisons on test plots for spring crops.

Variety	Moscow	Pullman, Wa	Cavendish	Bonners Ferry
	1979 spring crops (short tons/acre)			
Wheat				
WS-1		2.1		
Sawtell		2.1		
Twin		2.2		
Urzuie		2.2		
Fielder		1.9		1.3
Wared		1.9		
Wallady		2.0		
Wampum		2.0		
Dirkwin				1.2
Barley				
Steptoe		3.0		1.8
Larker		2.3		
Blazer		2.6		
Karl		2.2		
Vanguard		2.6		
Klages		2.6		
Advance		2.8		
Kimberly		2.7		
Triticale				
VT229		2.0		1.7
Palouse		1.9		1.6
M778867				1.4
Beagle				1.4
TA4196		1.7		
CB72		1.7		
CF76		2.2		

Table 5. Continued.

Variety	Moscow	Pullman, WA	Cavendish	Bonners Ferry
	1980 spring crops (short tons/acre)			
Wheat				
WS-1		1.7		
Sawtell		1.4		
Twin		1.7		
Urzuie		1.4		
Fielder		.9		1.2
Wared		1.7		
Wallaby		1.5		
Wampum		1.8		
Barley				
Steptoe		2.3		2.7
Larker		1.5		
Blazer		1.5		
Karl		1.7		
Vanguard		2.0		
Klages		2.1		
Advance		2.2		
Kimberly		2.1		
Triticale				
Palouse		1.8		2.2
VT75229		1.6		1.8
TA4196		1.4		
CB72		1.7		
CF76		1.9		
My07		1.3		
My13		1.9		
M292				2.5
Beagle				2.0
Lince				1.7

In Canada in 1980, about 50,000 acres of triticale were planted in Manitoba and about 18,000 acres in Alberta. The Manitoba production was reported to be going into the baking and milling industry.

Triticale as Human Food

Triticale has had mixed success as a human food. Lorenz (10) cited numerous studies on the food uses of triticale — baking, noodlemaking and brewing. Triticale whole grains are available in PNW health food stores or supermarkets, and a triticale specialty bread is available in some stores in California. Internationally, triticale is grown for human consumption in Canada, Kenya and South America.

One major West Coast bread mix distributor promoted triticale very heavily in the mid-1970s and initially had a good market. The grain was baked as bread and other bakery products and sold in western U.S. and Palouse area supermarkets. After about 2 years, sales fell off and the product was dropped.

An official of Westco Bakery distributors thought that triticale should have fared better, citing three reasons why the triticale bread product most likely failed: (1) a maple flavoring was added which may not have sustained public interest; (2) the name "triticale" may be too technical, unpronounceable or mysterious to attain public recognition or acceptance; and (3) triticale grain was difficult to obtain after the major supplier went bankrupt. He stated that his company had no interest in resuming production.

A University of Idaho home economist reported mixed results in tests of triticale flour. She felt that triticale was difficult to work with, had a distinctive flavor and had an unpredictable quality. She found variability in the gluten quality which seemed an outcome of the grain's location and season. Rye's disadvantage as bread flour — flatness — was present in the triticale.

Triticale as Animal Feed

Various university studies and on-farm experience have proven triticale to be a satisfactory animal feed ingredient. Farm animals including beef cattle, dairy cattle, chickens, turkeys and swine have been fed triticale on an experimental or commercial basis.

University studies on triticale as an animal feed reach back to the early 1970s. Lorenz (11) cited numerous early 1970 studies on triticale as cattle, sheep, swine, chicken and turkey feed. On the basis of average daily weight gain, feed consumption and efficiency of feed utilization (digestiblity), earlier generations of triticale as cattle feed were shown to

Table 6. Winter wheat, barley and triticale protein comparisons.

	Protein		
Variety	Percent	Digestible %	Relative nutritive value*
Winter Planting at Moscow, Idaho, 1978-79			
Triticale			
VT229	10.24	80.4	62.7
Palouse	10.11	80.6	53.7
Beagle	12.06	80.6	69.9
M778867	10.77	79.3	67.4
Barley			
Wintermalt	11.51	80.6	57.4
Schyler	10.45	81.9	70.8
Kamiak	10.58	80.7	60.9
Wheat			
Weston	13.18	77.0	53.4
Karkoff	12.07	77.5	53.4
Nugaines	12.01	79.2	60.4
Stephens	12.82	77.6	48.0
Spring Planting at Bonners Ferry, Idaho, 1979			
Triticale			
VT229	17.61	80.6	48.9
Palouse	17.66	78.9	57.6
Beagle	16.61	80.7	63.3
M778867	16.49	79.4	62.4
Siskyou	12.35	79.9	66.4
Barley			
Steptoe	12.14	79.0	66.0
Advance	14.22	79.0	89.2

*Percent based on relative growth of Tetrahumena pyriformis on casein for each crop variety. (A biological measure of nutritive value.)

Source: 3

Table 7. Essential amino acid profiles for selected crops compared with UN Food and Agriculture Organization (FAO) ideals.

Amino acid	Triticale	Triticale 204	Triticale 385	Wheat	Rye	Soy concentrate	Cotton seed	FAO ideals
Isoleucine	3.7	3.7	3.9	3.6	3.8	5.8	3.9	4.2
Leucine	7.6	6.7	6.4	7.6	7.4	9.9	7.0	4.8
Lysine	3.9	3.2	3.4	2.1	4.3	9.4	5.5	4.2
Methionine	2.6			2.2	2.3	1.5	2.5	2.2
Cysteine	1.8			1.6	1.9	1.0	1.6	2.0
Total sulfur-bearing amino acids	4.4			3.8	4.2	2.5	4.1	4.2
Phenylalanine	5.5			3.7	5.5	6.4	6.5	2.8
Tyrosine	3.4			3.2	2.4	5.0	4.2	2.8
Total aromatic amino acids	8.9			6.9	7.9	11.4	10.7	5.6
Threonine	4.0	3.1	3.1	3.6	4.4	5.6	4.4	2.8
Valine	4.3	4.7	5.0	4.4	4.7	5.4	4.9	4.2

Sources: 12 and 20.

be slightly inferior to conventional feeds, although ergot-free triticale compared better. Triticale as sheep feed was shown to be less satisfactory than corn. Some shortcomings with triticale were found in pig feeding studies, although triticale may be suitable as a chicken and turkey feed.

Triticale has been found suitable as a ruminant feed. Fernandez et al. (5) cited numerous studies concerning triticale as animal feed. Additionally, feed trials showed triticale could be used in the diet for laying hens at a rate of 80 percent. University of Idaho researchers estimate that 50 percent of a dairy cattle ration could be triticale, and the grain is being used successfully as dairy feed in central Washington.

Many studies give contradictory results about the merits of triticale. According to Rossi (15), this is caused by the considerable genetic variation among triticale lines. Furthermore, grain processing methods may influence the acceptability of triticale. In ruminant rations, studies showed acceptability and feed consumption were higher for steam rolled than for dry rolled grains.

Table 8. Worldwide production and locations

Area	Comments		
	Zillinsky[1]	Larter[2]	Gustafson[3] (1979 figures)
North America			
USA*		livestock and human use	80,000 ha
Canada*		baking uses	20,000 ha (22,000 ha in 1980)
Mexico*		poultry and hogs	2,000 ha (3,000 ha in 1980)
South America			
Argentina	grazing mostly	human use	20,000 ha
Australia*	4 varieties released in 1980	livestock feed	1,200 ha
Europe			
Poland			seed production
Russia*	200,000 ha	livestock feed	200,000 ha
Bulgaria*		animal feed	? ha
Italy*	1980 production		120 ha
France*	1980 production		2,000 ha (seed production)
Hungary*	1980 production		3,000 ha
Spain*			350 ha
Portugal			200 ha
Czechoslovakia			15 ha
East Germany			15 ha
Asia			
China*	20,000 ha		7,000 ha
Nepal			
Africa			
South Africa*	mostly grazing		15,000 ha
Kenya	500 ha in 1980 as bread and human food	human use	

*At least one or more licensed varieties coming from internal breeding programs. (Gustafson)

[1]F. J. Zillinsky. CIMMYT. Personal communication.

[2]E. N. Larter. Univ. of Manitoba. Personal communication.

[3]J. Perry Gustafson. Univ. of Manitoba. Personal communication.

Table 9. Livestock numbers in the PNW and Montana, 1974.

Livestock type	State				
	Oregon	Washington	Idaho	Montana	Total
	(000)	(000)	(000)	(000)	(000)
Cattle	1,559	1,223	1,917	3,212	7,911
Hogs	95	65	79	212	451
Chickens	2,216	4,276	917	886	8,295

Source: 17.

No recently published research on triticale from the PNW was found in the literature search for this study. Recent research results reflect improvements in triticale in the past few years. For example, ergot is less a problem than 10 years ago because of better seed development.

Triticale can be used as an animal feed in the PNW. It has the potential to substitute for barley and corn or soybean-based feeds, the latter two of which primarily are purchased in the PNW from the Midwest. Figs. 2 through 5 show PNW livestock numbers (feasible triticale markets) based on the 1978 Census of Agriculture. The figures are totaled in Table 9.

Washington State University research indicates that triticale has tremendous potential in the PNW and the Palouse. Triticale could be used in 50 percent of the feed ration for broiler chicks and 80 percent for laying chickens. The research estimates that 150,000 tons of triticale per year could be sold if available. Chicken feeders near the large PNW coastal cities are reportedly now using triticale as a feed.

Cattle feedlots near Great Falls, Montana, are using triticale. HDS Feedlots reported using 33 percent triticale, 33 percent barley and 33 percent alfalfa or barley silage plus a mineral supplement in their ration. The feedlot operator reported the decision to use triticale was the result of a dynamic process based on economics and energy quality. He felt that any feeder using wheat could use triticale.

A University of Idaho plant scientist predicts more triticale will be used by the cattle feeding industry since pilot tests have indicated it is fully equal nutritionally to other existing feed grains.

A northern Idaho hog feeder reported satisfactory results using 40 to 50 percent triticale in a triticale-barley ration in starting, growing and finishing pigs. He cited five advantages of triticale: (1) higher energy density, (2) lower fiber level in starter-grower rations compared to 100 percent barley, (3) about half the energy needed to process, (4) no evidence of whole kernels in fecal matter as with barley and (5) a better growth rate on finishing pigs with a 50-50 ration compared to a 100 percent barley ration.

Recent research indicates triticale can be substituted for corn and soybean meal in pig rations at a savings of about 170 pounds of soybean meal per ton of feed. Froseth (6) said triticale will be beneficial to hog feeders because the PNW does not produce significant quantities of corn or any of the common plant protein supplements which are usually fed to swine in other parts of the U.S.

The cost of shipping protein concentrates to the PNW is high and increasing — presently $50 per ton. Feed represents nearly 75 percent of the total cost of pork production.

Higher feed cost in the PNW is one reason swine production has not developed as rapidly as in other parts of the U.S. For example, nearly 90 percent of the pork consumed in Washington is produced outside the state.

The present delivered price of soybean meal is $350 per ton vs. the usually much lower barley- or corn-related price of triticale. Triticale effectively replaces soybean meal in poultry diets.

PNW feeders have not fully committed themselves to triticale because the supply has not been steady or dependable. Feeders are reluctant to use triticale under these conditions because it means mixing it in the ration for a period of time and then

Table 10. Potential tonnage of triticale as animal feed in the PNW.

	Number of livestock in PNW	Feed requirements	Maximum percentage of triticale possible in diet	Possible tonnage of triticale as feed
		(tons)	(%)	(tons)
Beef cattle	3,014,000	6,729,000	33	2,220,570
Dairy cattle	451,000	1,053,120	50	526,560
Swine	695,000	312,750	50	156,375
Broiler chickens[1]	32,752,000	131,008	50	65,504
Laying chickens	9,102,000	409,590	80	327,672
Turkeys[2]	1,275,000	38,906	85	33,070
Total				3,329,751

[1]Washington and Oregon only

[2]Oregon only

Source: 4.

Fig. 2. Livestock numbers and rank by county, Washington, 1978. Only those counties ranking in the top 10 for cattle, hogs or chickens are listed.

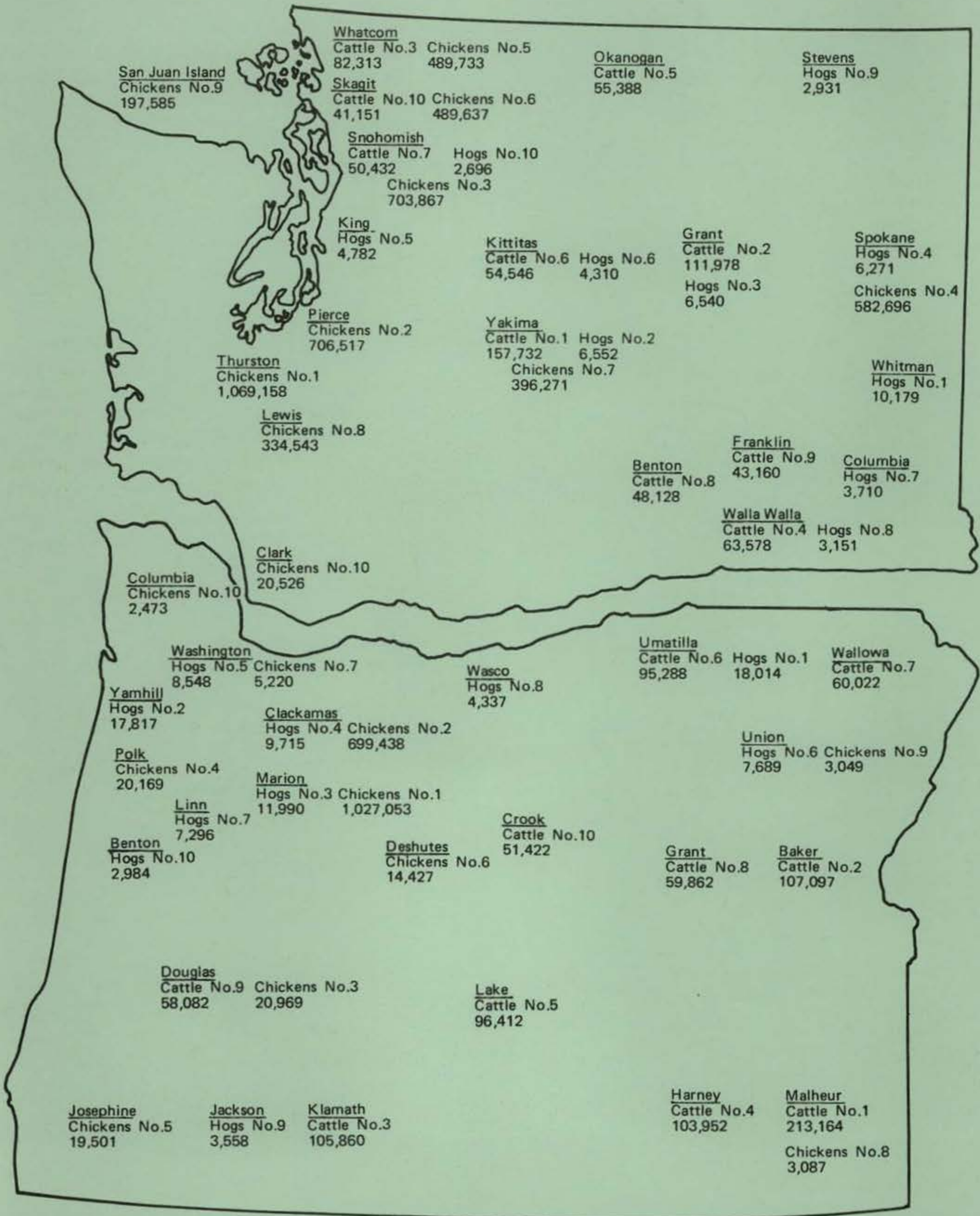

Fig. 3. Livestock numbers and rank by county, Oregon, 1978. Only those counties ranking in the top 10 for cattle, hogs or chickens are listed.

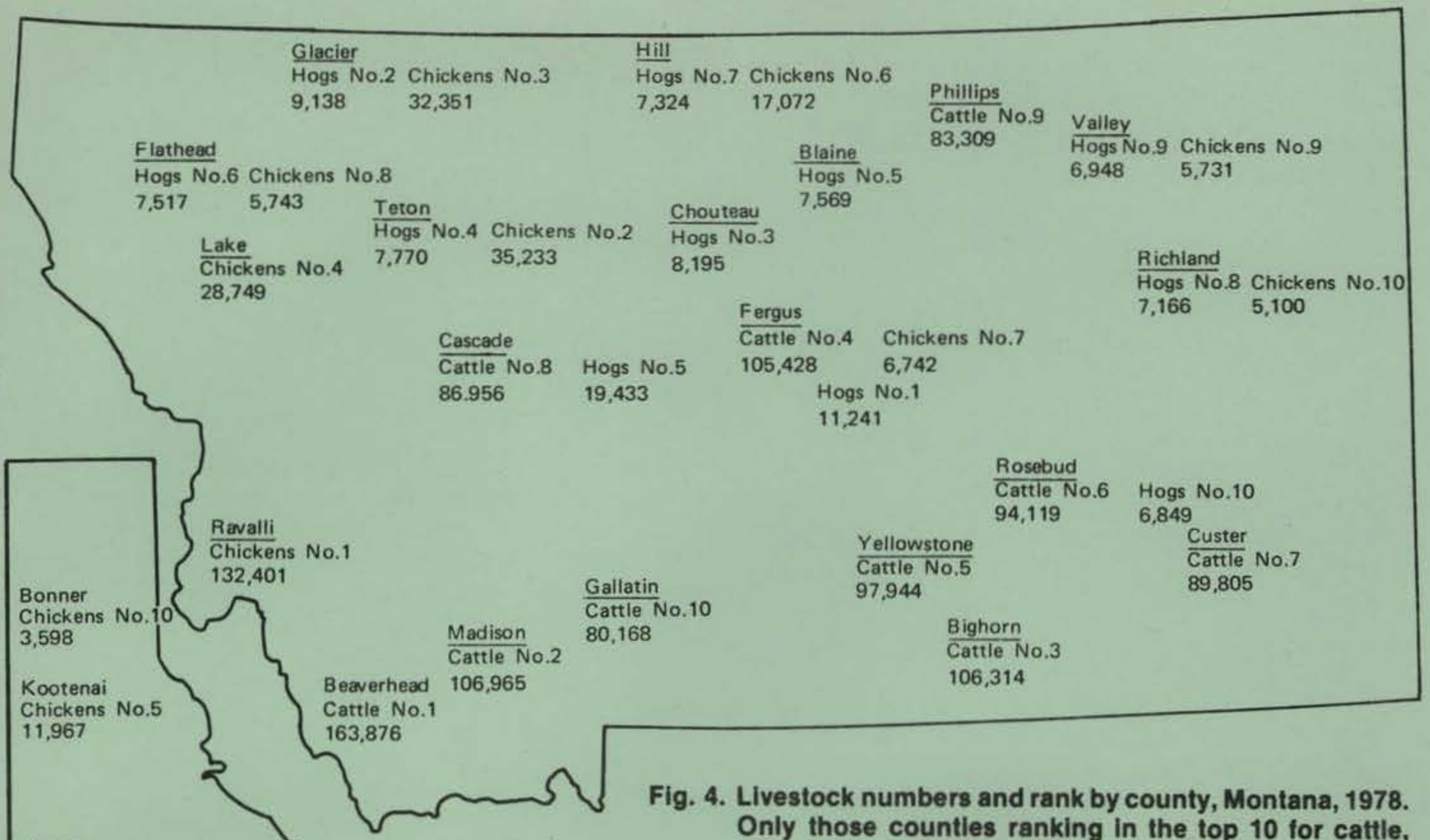

Fig. 4. Livestock numbers and rank by county, Montana, 1978. Only those counties ranking in the top 10 for cattle, hogs or chickens are listed.

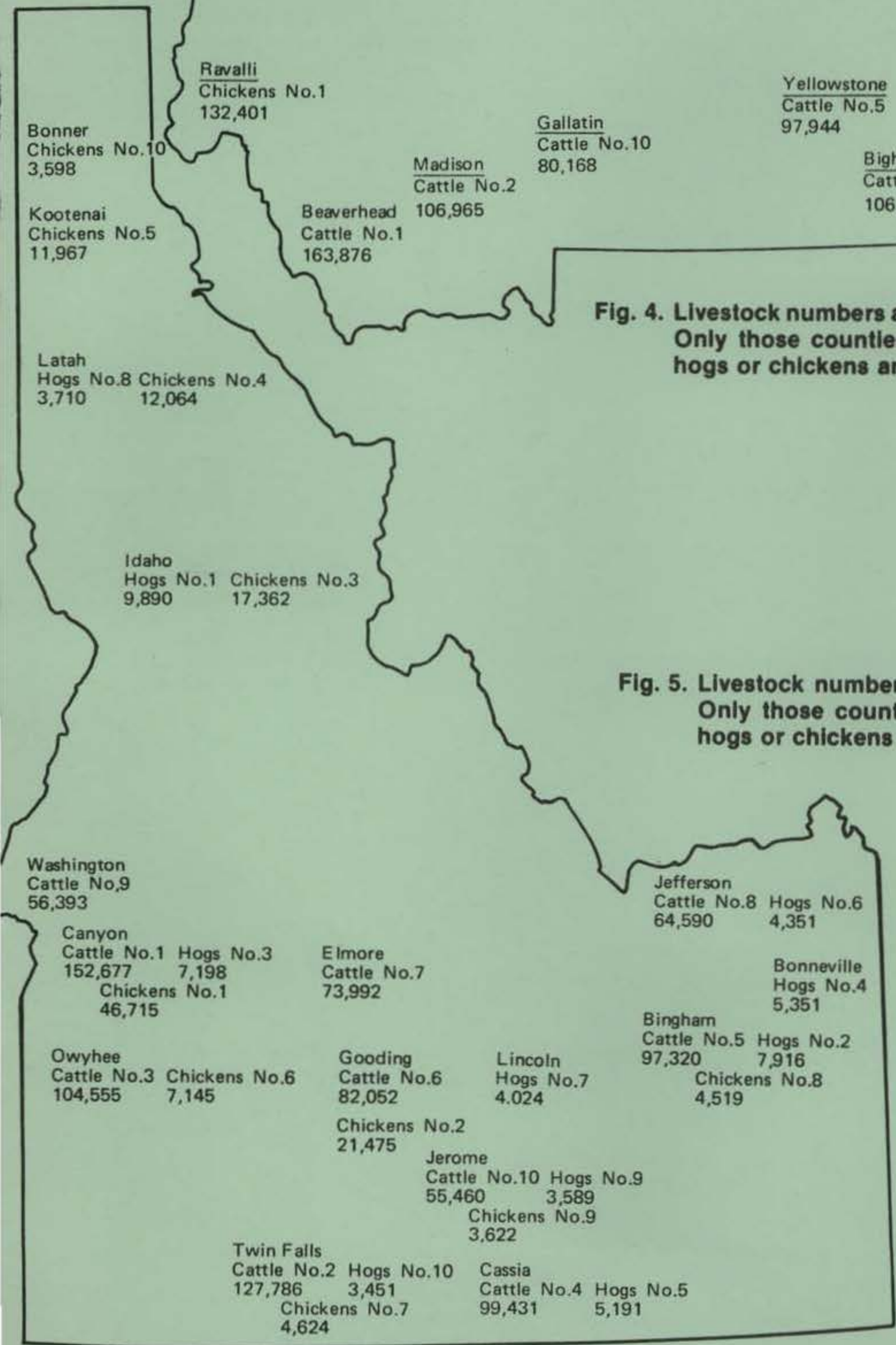

Fig. 5. Livestock numbers and rank by county, Idaho, 1978. Only those counties ranking in the top 10 for cattle, hogs or chickens are listed.

Figs. 2 to 5 are based on the 1978 Census of Agriculture, U.S. Department of Commerce, Bureau of the Census.

withdrawing it. Another industry spokesman said that a chicken feeder wants an assured 9-month supply so the feeding lifespan of chickens is covered.

A Montana feedlot uses triticale on a seasonal basis since owners cannot count on a steady supply at present. If the supply and the price were right, they could use triticale year-round. Present supply of triticale for this feedlot comes from Montana.

Feed markets for triticale exist in Idaho, Washington, Oregon and Montana. In 1979 in the PNW, 451,000 milk cows required 1,053,120 tons of feed, 3,014,000 other cattle required 6,729,000 tons of feed, 9,102,000 layer chickens required 409,590 tons of feed, 32,752,000 broiler chickens (Washington and Oregon only) required 131,008 tons of feed, 1,275,000 turkeys (Oregon only) required 38,906 tons of feed and 695,000 pigs required 312,750 tons of feed (Table 10).

Dairy cows can use triticale in up to 50 percent of their diet, cattle up to 33 percent, layers up to 80 percent, broilers up to 50 percent, turkeys up to 85 percent and pigs up to 50 percent. At those rates, triticale has a total potential usage of 3,329,751 tons as feed per year in the PNW. If the average yields were about 2,000 pounds per acre, more than 3 million acres would be required to produce that much feed. While this is by far an unrealistically high acreage figure, it does illustrate that a substantial market could be found for triticale as a livestock feed if it is accepted by feeders and growers and if it can be produced efficiently.

Prices

The price of triticale is not standard in the PNW at any given time. For example, the price was $91 per short ton in Great Falls in October 1980 or considerably less than feed barley. At the same time a grower in northern Idaho reported a triticale price of $10 a ton more than feed barley. HDS Feedlots in Great Falls reported the triticale price was similar to barley but at a slight discount.

Washington State University poultry scientist James McGinnis said one could not generalize about a triticale price. "Farmers don't really know what price to pay or charge," he said. He suggested setting a price by using the linear programming (LP) method of finding least-cost rations by replacing corn and milo in the LP formula with triticale at is higher protein (14 to 15 percent compared to 8 to 10 percent).

The difference in prices could be explained by local variations in supply and demand of triticale and competing feeds, local variations in protein and quality of triticale, and the fact that triticale is presently such a minor crop that not many are concerned about it. As more triticale is produced and used, a market price will be established as with other feed grains.

Exports, Marketing and Transportation

Triticale could be considered for export as a feed grain. Overseas recognition and interest in triticale appears to be strong. Foreign feeders could replace imported soybean meal with cheaper, imported some imported soybean meal with triticale meal. No information on actual current international movements of triticale was found.

The transportation infrastructure in the PNW is well developed with truck, rail and barge access to most areas, including the potential triticale production area. Triticale would be transported like wheat or barley, although a limited production quantity might not qualify for the unit-train rates that wheat gets. The barge system is mainly export oriented.

The Palouse and PNW are ideally suited geographically to supply Pacific Rim countries. The two major Northwest ports — Seattle and Portland — are closer to East Asian destinations than other U.S. ports.

China, Japan, Taiwan and Korea are likely to continue as strong markets for feed grains. Japan imported 11 million metric tons of feed grains from the U.S. in 1978-79 (out of 17.5 m.m. total imported tons) and 4.1 million metric tons of soybeans (out of 4.4 m.m. total imported tons). Corn and sorghum dominate the feedgrain imports, with barley declining in importance. Soybean used in oilmeal crushing is about 80 percent of the import total, with imports growing at 5 percent a year (13). If triticale can substitute for soymeal as researchers suggest, then Japan's feedlots are a potential market.

Korea and Taiwan are important barley importers (1). China, too, may become a large market if hopes of large scale trade materialize. An important food import agreement was signed recently between the U.S. and China. China's livestock production reportedly increased 24 percent in 1979 and livestock production (beef cattle, hogs and sheep) could reach 900 million by 1985 (9). Mexico is also an important feed market.

One potential bottleneck for triticale exports is whether the quantity forthcoming will interest the grain exporting industry. Since triticale cannot be mixed with wheat, special areas of elevator and terminal space would have to be allocated. Additionally, because of the concentration of the grain exporting industry in the hands of a few multinational corporations, these multinationals have a great deal to say over which commodities move in international trade.

Summary

Triticale has some production potential on PNW farms. The grain is valuable as a livestock feed because of its high quality protein. It also can be an acceptable human food but has not yet gained general consumer acceptance.

Because of its protein quality, triticale could be a partial substitute for protein supplements. Also, farmers would welcome a viable crop to help diversify production. Newly developed varieties have improved production, making triticale a possible substitute for barley in a crop rotation. Additional yield gains relative to wheat and barley are possible as triticale varieties are improved.

Triticale costs about the same to produce as wheat and uses the same equipment. It is a hardy crop and fairly drought resistant.

Past problems have left a lack of grower enthusiasm. Triticale promotion was misleading, and many growers and businessmen were exploited. Most of these problems have been corrected, but the memory lingers.

The major obstacle to production growth is lack of a definite market at satisfactory prices. Some livestock feeders would use triticale if it were available continuously. Many growers would produce it if assured of a fair market. Producers and users need to get together to solve this dilemma.

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