Issues and Alternatives in

Wheat Production and Marketing

With Emphasis on the Columbia Basin, Oregon

January 1970

Cooperative Extension Service
and the
Agricultural Experiment Station,
School of Agriculture
Oregon State University

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Introduction

The purpose of this publication is to stimulate discussions which will help Oregon's wheat industry,[1] at both the individual producer and industry organization level, to arrive at decisions regarding future courses of direction. It grew out of concerns of the School of Agriculture, Oregon State University, and industry leaders regarding the present and longer-run alternatives facing wheat producers. At the same time it was apparent that an analysis of factors affecting wheat alone would be inadequate, since some of the potential alternatives are outside the wheat economy, and others are closely interrelated with wheat. Therefore, the report was broadened to encompass the use of wheat as a feed grain in terms of expanded livestock and poultry feeding industries. To a lesser extent, attention was given to alternative crops which might replace some of the present wheat acreage, particularly in areas where irrigation developments exist or are potential. This question requires further research before definite directions can be presented; such research is beyond the scope of this report, which was based mainly on bringing together existing knowledge for analysis.

While the report purports to deal with wheat production and marketing problems of Oregon, much of what is described relates to a broader region than the geographic limits of Oregon. At the same time, when alternatives for individual farmers are concerned, much of the report becomes specific to the Columbia Basin wheat-producing counties, since it is in this region that the most difficult decisions regarding production alternatives must be made.

Wheat is important to the state's economy. Cash receipts from farm marketings of wheat were nearly $38 million in 1968, about 7 percent of all Oregon cash receipts from farm marketings. The current receipts are approximately double the level in 1942. In addition, government payments to Oregon farmers under the wheat program totaled $16,100,000 in 1968, down slightly from the record high reached in 1967.

Based on 1968 estimates, nearly two-thirds of Oregon's wheat production is located in the North-Central counties. Umatilla County produces over a fourth of Oregon's total production. The next five counties in terms of production are Sherman, Morrow, Gilliam, Wasco, and Union. The counties comprising the Willamette Valley accounted for another quarter of Oregon's production in 1968.

In 1969, 834,000 acres were planted to wheat, and around 789,000 acres were harvested. An average yield of 2,238 pounds per harvested acre resulted in a preliminary production estimate of 885 thousand tons.[2] Total Northwest production is placed at 3.8 million tons, and U.S. production is estimated to be 43.8 million tons.

Prices received by Oregon farmers for wheat in 1968-69 were at the lowest level since 1942. Wheat prices tended to reach a high in the early 1950's and have declined since. Over this same period (1942-68), Oregon prices received for all farm products have risen 60 percent, while the Consumer Price Index has more than doubled. Over the same period of time (1942-68), wheat production in Oregon increased to half again its 1942 level. Acreage is only slightly above 1942 levels, but yield per acre has risen a third to account for the increased wheat production.

The main sections of the report deal with the nature and scope of the Pacific Northwest wheat situation; the PNW wheat producers problems; feed grain requirements and potentials for the PNW; potentials for a feed-oriented grain industry; quality considerations of wheat marketing; production adjustments and alternatives; group bargaining; and industrial alcohol as a potential use of wheat.

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[1] This report refers principally to white wheat—the primary class of wheat grown in the PNW. Hard red winter wheat will be discussed mainly as a production alternative to white wheat.

[2] In this paper, weights are expressed in units of pounds, hundredweight, or tons, whichever is appropriate. Tons are expressed in terms of 2,000 pounds.

Nature and Scope of the Pacific Northwest Wheat Situation

Federal Wheat Programs

Federal price programs have traditionally been an important feature of the U.S. wheat industry. Until 1964 Federal wheat programs were based on wheat acreage allotments (to control supply) and relatively high price supports to growers (to enhance and stabilize growers' income). This type of program priced wheat out of feeding markets for all practical purposes. It also led to a situation whereby U.S. prices were higher than export (world) prices, so the government was forced to pay "subsidies" to export firms in order to make U.S. wheat competitive on world markets. This program had another impact: it contributed to production in excess of market requirements for food use and led to fairly large stocks of wheat held by the Commodity Credit Corporation. The enactment of P.L. 480 in 1954 was largely designed to eliminate surplus stocks of agricultural commodities, particularly wheat. Although the aims of P.L. 480 have gradually shifted to using farm products to encourage economic development in developing countries, the continuing surplus stocks have made P.L. 480 a convenient program to both dispose of stocks and to encourage foreign economic development.

Beginning in 1964 Federal wheat programs shifted away from the relatively high price supports that had prevailed. Instead, price supports were lowered and growers who voluntarily participated in wheat programs by limiting wheat acreage received a certificate payment to supplement their incomes. This reorientation was the basis of the Food and Agriculture Act of 1965, which expires with the 1970 crop. The U.S. Congress is now in the process of designing farm legislation for the 1970's. Many alternative programs are being considered in the political process.[3] Twenty-six farm groups, including the National Association of Wheat Growers, combined to support a program basically the same as the 1965 Act. The type of program adopted will have a major influence on the future direction of the PNW wheat industry. It will affect the quantities of wheat grown in the future, the potential for expanding wheat feeding, the competitive position of the U.S., and PNW wheat in world markets, the competitive position of the PNW relative to other regions in the U.S. (especially the soft red winter producing region), the need for economic adjustment in Oregon's Columbia Basin counties, and the incomes of Oregon wheat growers.

World Wheat Production Trends

Because about 85 percent of PNW white wheat production has been exported in recent years, this outlet is the most crucial variable in assessing the present situation and planning for the future. White wheat is used for different purposes (noodles, crackers, pastries, cookies) than other classes of wheat. Nevertheless the total world wheat situation influences white wheat markets and PNW exports, and must be included as background for understanding the PNW situation.

World wheat production has grown rapidly in the past 20 years. Table 1 shows the extent to which the growth has taken place by major geographic areas. The 1949-68 20-year period is divided into four periods of 5 years each. World production averaged 205.5 million tons in the 1949-53 period; it increased gradually during the 1954-58 and 1959-63 periods. But the increase accelerated in the last 5-year period—averaging 322.3 million tons or 57 percent above the 1949-53 period.

Western Europe has accounted for 16 percent of the increase in world production from 1949-53 to 1964-68. This has resulted entirely from higher yields. About 44 percent of the increase resulted from higher production in the USSR. Their higher production came from approximately equal in-

[3] The effect of alternative programs on a representative Sherman County wheat farm are discussed in a mimeographed report available from the Department of Agricultural Economics, OSU, Nov. 1, 1969.

TABLE 1. WORLD WHEAT PRODUCTION, BY MAJOR GEOGRAPHIC REGIONS, FIVE-YEAR AVERAGES, 1949-53, TO 1964-68[a]
(All figures in millions of tons)

Geographic regions	Average 1949-53	Average 1954-58	Average 1959-63	Average 1964-68
Western Europe	35.0	40.8	46.2	53.7
a. France	8.9	10.4	12.4	15.2
b. Italy	8.5	9.6	9.1	10.4
Eastern Europe	12.8	12.7	14.9	20.3
U.S.S.R.	38.8	64.3	70.6	90.0
N. & Central America	50.5	46.6	52.5	64.1
a. Canada	16.3	13.3	15.2	19.9
b. USA	33.5	32.0	35.7	42.0
South America	8.5	10.4	9.2	10.7
a. Argentina	5.9	7.2	6.7	8.1
Asia (ex. M. China)	24.7	30.5	35.5	40.8
Mainland China	24.3	27.3	23.8[b]	24.3[b]
Africa	5.1	6.2	6.1	6.7
Oceania	5.9	5.0	8.4	11.8
a. Australia	5.7	4.9	8.1	11.4
World Total	205.5	243.8	267.1	322.3

Source: *World Wheat Statistics*, International Wheat Council, London (various annual issues)

[a] Years given are crop years, e.g. 1960 refers to harvest during 1960 in Northern hemisphere (mainly after July 1, 1960) and subsequent harvest in Southern hemisphere.

[b] Unofficial.

creases in both yields and acreage. North America contributed about 12 percent of the world increase as a result of higher yields on substantially smaller acreage in 1964-68 compared with 1949-53.[4] Asia contributed 14 percent of the increase as a result of acreage expansion in the 1950's and early 1960's followed by yield improvements for the 1964-68 period. The remaining 14 percent of the increase in world production occurred in eastern Europe (mainly yield improvements), Africa (acreage expansion), and Australia (mainly acreage expansion). In total, world acreage expansion was twice as important as yield improvements between 1949-53 and 1954-58 (even though North American acreage decreased 26 percent between the two periods). Between 1954-58 and 1959-63 total production growth was relatively small, and came primarily from higher yields. Production increased sharply (21 percent) from the 1959-63 period to the 1964-68 period. The upsurge in production for this last 5-year period resulted in part from significant acreage expansion in the USSR, North America, Argentina, and Australia. But higher yields were twice as important as acreage expansion, and all major geographic areas except Africa and Australia experienced sharply higher yields. Generally favorable weather over this period (except for South Asia) was a major contributing factor to the higher yields.

The 1960's began in a period when world wheat production was growing slowly, but with ample world wheat stocks held primarily in the United States.[5] The early 1960's witnessed a major jump in imports by the Soviet Union and Mainland China. Then beginning in 1965 India and Pakistan faced food crises that led to doubling of wheat imports for three years. This drew down world stocks so that by July 1, 1966, U.S. stocks were 12.8 million tons, only 40 percent of the July 1, 1960 stocks. Partly as a result of the tighter world wheat situation and due to the favorable weather noted above, production increased sharply beginning in the mid-1960's. The world food crisis so freely predicted has not materialized. In fact, many less developed countries have benefited from the new varieties first developed in Mexico that are doubling and tripling yields where they are being adopted. The effect of these factors has been to completely reverse the world wheat situation in 3 years. Stocks held by the U.S., Canada, Australia, and Argentina on July 1, 1969, have returned to their 1960 level, and in addition the European Common Market entered the picture with a stock of 10 million tons. One difference is that the U.S. held less stocks than in 1960, while Canada, Australia, and the Common Market held significantly more.

U.S. and PNW Exports

These world developments in wheat production resulted in a major decline in U.S. and PNW wheat exports during the 1968 crop year. Figure 1 shows that PNW white wheat exports declined to 2.7 million tons in 1968—an amount comparable to the 1959-65 period but significantly less than 1966 and 1967 exports. So far exports in 1969 are running at about the same levels as in 1968. The upper line in the chart shows total PNW exports, including wheat shipped in from other areas. In recent years the quantities of wheat exported through PNW

[4] North American acreage was, however, much lower in the two middle periods than in the 1964-68 period.

[5] On July 1, 1960, the U.S. held 1.3 billion bushels and the other three major exporting countries at that time (Canada, Australia, and Argentina) held .8 billion bushels. *Foreign Agriculture*, USDA, Nov. 24, 1969.

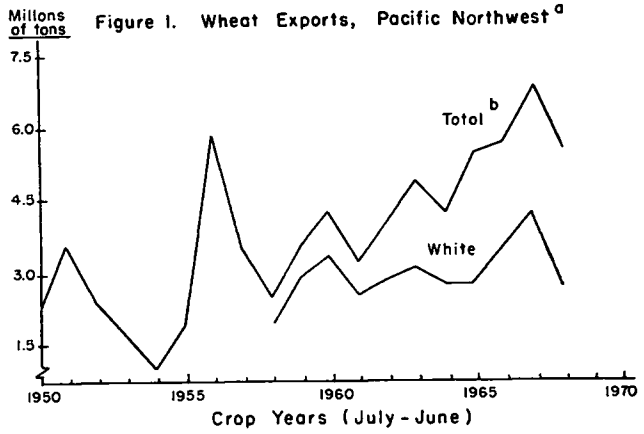

Figure 1. Wheat Exports, Pacific Northwest [a]

ports have increased steadily as a result of higher percentages of Great Plains produced wheat being shipped to the Pacific Rim countries.

The prospects for future U.S. wheat exports are not particularly encouraging in light of the world wheat situation. And the PNW export scene may well be even less optimistic. More than 60 percent of PNW exports have been moving under provisions of Public Law 480. Concessional sales under Public Law 480 are expected to trend downward in the future, due to a basic reshuffling of food aid programs, a trend toward self-sufficiency in several developing countries of Asia, and a tight budget situation in this country. There will continue to be some food aid shipments, but these outlets are unlikely to take the volume of PNW white wheat that has moved under this program in the past.

In Japan, the major cash market, some 40 percent of imported wheat is used for noodles. But the trend is toward consumption of more bread and rolls. Also, the current popularity of "ramen" noodles, which do not require as high a proportion of white wheat, is cutting into usage of PNW exports. Any growth in demand for food wheat in Japan will most probably be for hard red bread type wheats, not for white wheat.

Other cash markets in Asia are also assuming increasing importance. However, the trend in these countries is also toward construction of bread bakeries to satisfy a growing demand for bread, which holds a high degree of status as well as being a convenience food. Noodles are considered inferior to bread or rice in most Asian countries—perhaps not from a taste standpoint, but ranked nonetheless as a "lower-class" diet item.

In 1968-69 the Philippines provided the second largest cash market for white wheat. At present the U.S. dominates the market for imported wheat in The Philippines. But only 20 percent of The Philippines' cash imports are of white wheat, and this is slated to decrease even more in the future.

Taiwan is also an important cash market. The U.S. satisfies 90 percent of Taiwan's wheat import needs. Several years ago Taiwan imports consisted of 60 percent white and 40 percent hard red winter wheat. Today that proportion is reversed, with 60 percent hard red and 40 percent white.

Korea holds good potential as a cash market for U.S. wheat—imports may reach 3.3 million tons in the next 3 years, compared with total wheat imports of 1 million tons in 1967-68. But the trend in Korea will also inevitably be toward more use of bread-type wheat, with marketing opportunities for hard red winter wheat increasing more rapidly than opportunities for white wheat.

India and several other Asian countries would prefer to import wheat and export rice, because of the world price differential between the two grains. But rice, too, has the potential for becoming a surplus grain in Asia within a decade as the new varieties increase yields. If the household market continues to be the largest outlet for U.S. wheat in India, white wheat will continue to be competitive because the housewife prefers it for chapatis. But there are already some indications of a shift from chapatis toward bread consumption in India.

There will be other outlets for Public Law 480 wheat for some time to come, in parts of Africa, Indonesia, and several other countries. There will also be cash markets for hard red wheats in Western Europe, where soft wheats are the predominant native wheat; and some cash markets throughout Asia for many years. But these markets hold little promise of absorbing the growing production potential of PNW white wheat in future years.

The basis for concern about future export levels arises from the following developments:

1. Four consecutive years of high world wheat production, averaging about 25 percent more than the preceding 6 years (1960-65). To the extent that higher yields have resulted from improved production technology, we can expect them to be sustained or even further increased in the future. But generally favorable weather conditions over

these 4 years would indicate that future yields probably will not continue to increase as rapidly.

2. A high probability that food grain production in developing countries (especially Asia where most PNW wheat has been shipped) will grow as fast as increases in demand from population and income growth. If this is true, the need for food aid in the form of grain will diminish relative to what it has been in the last decade.[6] There will, however, continue to be some opportunity to ship grains to certain areas of the world on a regular basis and to most developing countries periodically when unfavorable weather results in short crops.

3. India and Pakistan have sharply increased their food grain yields and production and consequently are not receiving as many concessional food aid shipments from developed countries.[7] New varieties of wheat, rice, and corn and their improved practices have been the major contributing factors to the higher yields. And to date only a relatively small proportion of the potential cropland has been planted to the new, higher-yielding varieties. On the surface, the evidence suggests that the need for food aid will decline during the 1970's. Some experts are even giving serious consideration to the possibility of expanding animal production in developing nations as a way of converting grains to more urgently needed high-protein foods.[8] This course of action would also provide some buffer for the year-to-year fluctuations in grain production that characterize developing countries.

4. A near certainty that commercial exports will face very keen competition over the next decade. Because French exports are more directly competitive with white wheats than with other classes of wheat, and because Australia now follows a grading scheme that results in greater competition with the PNW, it would appear than PNW exports may face even stiffer competition than total U.S. commercial exports.

[6] The possibility of expanded food aid in the form of high protein foods could increase substantially.

[7] Certain reservations should be mentioned about the optimistic outlook for grain production in developing countries. First, the problem of diseases and insects remains crucial. For wheat, the new varieties are similar genetically and their expansion could be deterred if nations do not adopt a continuing and expanded research program to provide newer varieties and methods of disease and insect control. Second, the new wheat and rice varieties are unpopular with consumers and are therefore selling at discounted prices relative to native varieties. This will discourage rapid expansion unless varieties are developed which are more acceptable to consumers.

[8] The forthcoming Indicative World Food Plan by the Food and Agricultural Organization of the U.N. recommends expansion of pork and poultry production in developing countries. A move in this direction may actually increase the opportunity to ship feed grains under P.L. 480 in years when production is inadequate to sustain pork and poultry production.

The Pacific Northwest Wheat Problem in Perspective

Wheat-Fallow Farms, Oregon-Washington

The "typical" commercial wheat-fallow farms in Oregon and Washington are generally about 1,500 acres in size, and harvest crops on about a third of this acreage. Crops harvested are mostly winter wheat with smaller amounts of spring wheat, hay, and other small grains. Livestock provides around 10 percent of cash receipts.

These wheat-fallow farms in 1968 had an estimated return to labor, management, and capital of $20,374.[9] [10] Assuming a 6 percent return to the $198,000 invested in land, buildings, machinery, and equipment, the return to the family's labor and management is reduced to $8,481.

Net farm income from wheat-fallow farms has increased about 75 percent since 1954. Net farm production of all commodities produced on wheat-fallow farms has increased nearly 75 percent, while operating expense per unit of production fell 28 percent. Over this period (1954-68) prices received for *all* products sold fell 37 percent while prices

[9] Net farm income is the return to operator labor and management, and capital. No allowance has been made for payment of rent, interest, or mortgage. Farms are assumed debt-free, and producers are full owners.

[10] "Farm Costs and Returns—Commercial Farms by Type, Size, and Location," Economic Research Service, USDA. Agricultural Information Bulletin 230. Revised September 1969.

paid increased 27 percent. Meanwhile, per capita income of all Oregon residents rose by 77 percent since 1954.

The current economic conditions do not mean that all wheat growers are experiencing exceedingly low net incomes which would lead to large-scale disaster. Although some undoubtedly are in serious financial condition, the average grower in Columbia Basin counties is still receiving larger net incomes than the average farmer in many other areas of Oregon and the United States because he has a large, efficient operation. The difficulty is that net incomes are not as large as they have been in recent years, and returns to the large capital investments have been diminished.

The Individual Wheat Grower's Situation

There is no question that Oregon (and PNW) wheat industry currently faces a serious economic and price problem. But individual grower's concerns extend beyond their current or short-run position, and extend to the uncertainty facing the industry for the long run: there is uncertainty about the nature of domestic and foreign governmental programs for the 1970's; about market outlets for white wheat; and about available production and marketing alternatives if the export market for white wheat diminishes.

A primary concern is, of course, the current price and income situation of wheat producers. As previously stated, wheat prices for the 1968 crop were at their 27-year lowest level and have improved only slightly for the 1969 crop. Farming costs have increased substantially, along with inflation. Except for increased efficiency that has reduced unit costs, incomes would have been much lower than they have been. Interest rates on new loans for operating capital and business expansion are higher than at any time in recent history. And because of the unfavorable world supply-demand situation for wheat, the wheat acreage allotments have been decreased by about 13 percent for 3 consecutive years. The 1970 national allotment is 12 percent below the previous historic lows of 1966 and 1969. Moreover, in certain areas of Oregon unfavorable weather in recent years has lowered yields and production. This has not only a direct effect on income, but it also lowers the "yield history" of the farm which is one basis for determining wheat program (certificate and diversion) payments.

Probably the best indicator of the significance of the situation described above is in the land market. The historic climb in land prices has leveled off, at least temporarily; relatively few farms offered are being sold.

PNW White Wheat Production and Use

Pacific Northwest grown white wheats and eastern soft wheats have similar characteristics and are used for similar food purposes—pastries, cookies, crackers, and cakes. However, most wheat used for these purposes in the U.S. is soft red winter produced east of the Mississippi River. This eastern region produces nearly one-fourth of total U.S. wheat production. About 4.5 to 4.8 million tons is used domestically, mainly being milled for food use. In contrast, in recent years only 240,000 to 300,000 tons of PNW white wheat has been milled domestically for flour. This outlet has been negligible, and it seems unlikely that mills in the PNW will expand significantly at the expense of mills that use soft red winter wheat.

Cash and P.L. 480 market outlets for PNW white wheat at present are limited to about 2.7 million tons for export, 300 to 400 thousand tons for milling and seed uses, and the same quantity for feeding. Against this market requirement of 3.3 to 3.6 million tons, the production potential in the PNW is strong and growing steadily due to improved varieties and production practices. This potential is easily 4.5 to 5.25 million tons and could expand substantially above that in the years ahead. Only by diverting acreage to other uses (often non-production) through Federal wheat programs has it been possible to limit PNW production to 4.26 million tons in 1968 and about 3.6 million tons in 1969. Unless white wheat exports expand above the 2.7 million tons shipped in 1968, the necessity of either further limiting production or significantly expanding feeding, milling, or industrial uses will exist. And even if production is limited to the current market requirements of 3.3 to 3.6 million tons, wheat growers will probably experience unfavorable income prospects. Reduced wheat production can result from some type of land retirement pro-

gram or switching land to the production of other crops. However, there are few alternative crops for dry-land wheat grown in the Columbia Basin counties. Historically barley has been the principal alternative.

It is possible that increased feeding of wheat to livestock and poultry could result in the PNW if appropriate industry and government decisions are made. An analysis of PNW feed grain requirements follows.

Feed Grain Requirements and Potentials in the Pacific Northwest

The major industry thrust for the marketing of wheat, aided by Federal pricing policies, has been for sales for food consumption. In view of the problems that now face the PNW wheat industry as described in earlier sections, attention is given in this section to whether PNW grains meet the requirements of livestock and poultry feeding, and the economic considerations of feeding alternative grains.

Livestock and Poultry Production-Consumption Balance

Figure 2 shows wheat and barley prices at Portland, and quantities of wheat fed to livestock in the Pacific Northwest. There is an inverse relationship between wheat prices and quantities fed. When wheat prices fell below barley prices in 1965, wheat feeding increased substantially. A similar situation occurred during 1968.

Tables 2, 3, and 4 summarize the production-consumption balances for beef, cattle, hogs, and turkeys in the Pacific Northwest states and in California. For example, Table 2 shows that Oregon consumed the equivalent of 407,422 head of beef cattle in 1968. During the same period there were 347,400 head of cattle slaughtered in the state, resulting in a slaughter deficit of about 60,000 head. Further, there were only 181,000 head of cattle fed to slaughter weights and grades in 1968, resulting in a production-consumption deficit of 226,442 head. This means that many cattle were shipped into Oregon (in live, carcass, or processed products form) to meet the state's consumption requirements. Oregon and Washington are deficit in the production of fed beef, while Idaho is surplus,

Figure 2. Relation Between Grain Prices and Wheat Used for Feed Pacific Northwest, 1950-1968

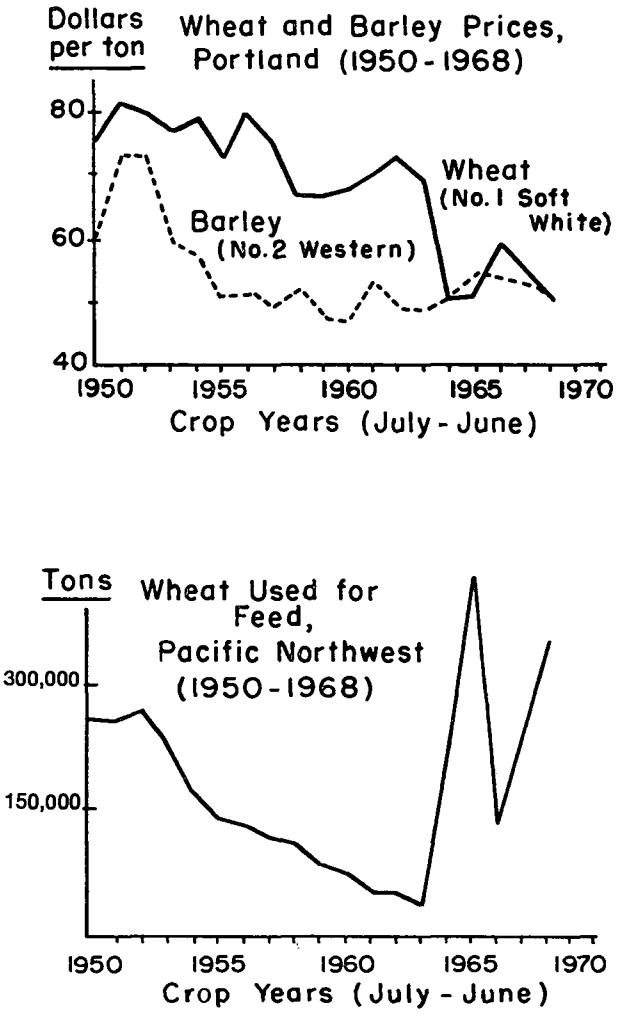

Table 2. Beef Cattle, 1968

Item	Oregon	Washington	Idaho	PNW	Calif.
No. head consumed	407,422	641,622	138,748	1,187,792	3,779,110
No. head slaughtered	347,400	592,500	356,500	1,296,400	2,919,000
Slaughter surplus (Deficit)	(60,022)	(49,122)	217,752	108,608	(860,110)
No. fed cattle marketed	181,000	332,000	412,000	925,000	2,068,000
Production-consumption surplus (Deficit)	(226,442)	(309,622)	273,252	(262,812)	(1,711,110)

Table 3. Pork, 1968

Item	Oregon	Washington	Idaho	PNW	Calif.
No. head consumed	779,214	1,282,413	286,012	2,347,639	7,458,772
No. head slaughtered	268,300	793,000	140,100	1,201,400	1,628,000
Slaughter surplus (Deficit)	(510,914)	(489,912)	(145,912)	(1,146,239)	(5,830,772)
No. marketed	183,000	122,000	181,000	486,000	230,000
Production-consumption surplus (Deficit)	(596,214)	(1,160,413)	(105,012)	(1,861,639)	(7,228,772)

Table 4. Turkeys, 1968

Item	Oregon	Washington	Idaho	PNW	Calif.
No. birds consumed	1,034,613	1,822,933	354,591[*]	2,857,606	9,453,478
No. birds produced	1,921,000	577,000	.....	2,498,000	14,312,000
Production-consumption surplus (Deficit)	886,387	(1,245,993)	.....	(359,606)	4,858,522
No. marketed	1,940,000	589,000	.....	2,529,000	14,337,000
Marketing-consumption surplus (Deficit)	905,387	(1,233,993)	.....	(328,606)	4,883,522

[*] Idaho is a deficit production state, but numbers produced and marketed are not published in 1968 to avoid disclosing individual operations in 1968.

Table 5. Grain Production and Feed Grain Utilization, 1967

Item	Oregon	Washington	Idaho	PNW[1]	Calif.
Total grain production (Tons)	1,284,924	3,861,064	2,451,492	7,597,480	3,514,180
Grain consuming animal units	982	1,273	729	2,984	7,155
Grain consumed as feed grain (Tons)	691,328	896,192	513,216	2,100,736	5,037,120
Additional grain available for feeding (Tons)[2]	593,596	2,964,872	1,938,276	5,496,744	(1,522,940)
Percent of grain production available for additional feeding[3]	46.20%	76.79%	70.07%	72.35%	.....

[1] PNW includes the states of Idaho, Washington, Oregon.
[2] "Available" as used here means available for feeding to livestock or poultry if total grain production was utilized as feed grain.
[3] Means percent available.

Table 6. Grain-Consuming Animal Units and Tons of Grain Consumed by Class or Poultry, 1967

Class of animals or poultry	OREGON		WASHINGTON		IDAHO		CALIFORNIA	
	Number[1] animals	Tons grain consumed	Number[1] animals	Tons grain consumed	Number[1] animals	Tons grain consumed	Number[1] animals	Tons grain consumed
Milk cows	186	130,937	289	203,615	173	121,478	1,094	769,672
Meat cattle	181	127,412	196	138,014	264	185,733	1,085	764,131
Hogs	158	111,442	130	91,770	117	82,679	206	145,069
Hens, pullets, and chickens	220	154,581	444	312,412	84	58,866	2,812	1,979,085
Broilers	88	62,289	159	111,665	41	28,945	519	365,191
Turkeys	119	83,789	38	26,886	15	10,880	1,370	964,608
Sheep	18	12,513	7	4,660	26	18,168	54	38,282
Horses and mules	12	8,365	10	7,170	9	6,467	15	11,082
Total	982	691,328	1,273	896,192	729	513,216	7,155	5,037,120

[1] Add 000.

leaving a net deficit of over 260,000 head of fed cattle in the PNW in 1967 and 1968. California has a large and increasing beef deficit which totaled 1.7 million head in 1968.

All three of the PNW states produce less pork than they consume. In total these states are nearly 2 million head deficit relative to a production-consumption balance. California shipped in more than 7 million hogs (live or carcass) the last 2 years to meet her consumption requirements. Oregon produces a surplus of turkeys, but Washington and Idaho are deficit, making the PNW a net deficit turkey producing area. California produced nearly 5 million more turkeys than she consumed in 1968.

The PNW states and California are deficit in the production of chicken broiler meat. In 1967 the combined production deficit of the Pacific Coast states (Washington, Oregon, and California) was about 88 million birds. The PNW is self-sufficient in dairy production, with fluid milk normally moving from the surplus production areas of Washington and Idaho into Oregon, where consumption exceeds production.

Thus, it can be seen that potential does exist for increasing livestock production in the PNW to meet the region's consumption requirements, and possibly to supply the large and expanding California markets for livestock products. However, the region's ability to realize this potential depends upon its competitive position relative to other production regions. That is, PNW livestock producers and processors must be able to produce and supply their products in these markets at prices, quantities, and qualities that are competitive with products being shipped in from surplus production regions.

Quantities of Feed Consumed

Table 5 shows the amounts of feed grains that were consumed in 1965 and 1967 in the PNW states and in California. Oregon livestock consumed around 700,000 tons, Washington about 900,000, and Idaho over 500,000 tons in these two years. This puts PNW feed grain consumption by all livestock species at about 2.1 million tons per year. California's livestock industries consumed over 5 million tons in 1966 and 1967.

Most of the grain fed in the PNW in recent years has been barley. For example, Oregon cattle feeders buy locally-produced barley from harvest time until this supply diminishes; then they must procure barley from Montana and southeastern Idaho to meet their requirements. Limited amounts of locally-produced wheat are fed to cattle, hogs, sheep, and poultry regardless of the price of food-quality wheats. In periods like the summer of 1969, when all wheat was a competitively priced livestock feed, the quantities of wheat moving into livestock feeding markets increased substantially. However, some cattle feeders will not feed more than 50 percent wheat rations because of apparent digestibility problems.

Substantial quantities of corn, grain sorghum, and soybean meal are shipped from the Midwest and Great Plains into Washington, Oregon, and California. Tonnages of feed grains shipped into the PNW have been around 400,000 to 500,000 tons annually. While there has undoubtedly been a shift toward using more wheat in poultry rations during the past 2 years because of price relations, midwestern feed grains will be expected to con-

tinue to flow into the PNW unless this region supplies dependable quantities of wheat at competitive prices.

Table 5 also shows the additional amounts of grain that would be available for feeding in the PNW, assuming *all* grain produced in the region was fed. An additional 5.5 million tons would have been available in 1967, and this quantity, if fed, would have permitted a doubling of all livestock production in the PNW region.

Table 6 shows the number of grain-consuming units by class of livestock or poultry for Oregon, Washington, Idaho, and California. In all but Idaho, hens, pullets, and chickens represented both the largest number of grain-consuming units and tons of grains consumed. In Idaho, meat cattle were in largest number on both counts.

Economics of Feeding Wheat

Several factors influence the economics of substituting wheat for feed grains in livestock rations. These include the nutritive quality of wheat, the class of livestock fed, the relative prices of the feedstuffs, and the experience of the livestock feeder.

The nutritive analysis of wheat varies by type of wheat and from one season to the next. The gross energy content of soft white wheat is almost equivalent to corn on a pound-for-pound basis. The protein content of wheat, however, will normally vary between 8 and 10 percent.

Wheat, as a feed, presents some special problems. It is highly palatable, and hogs may overeat when wheat is fed free-choice. For hogs, wheat can replace all the grain in the ration.

Cattle are hard to keep "on feed" with rations made up of a high proportion of wheat. With both cattle and sheep, nutritionists and feeders disagree on the maximum proportion of wheat in the ration. However, a typical recommendation is that wheat should not replace more than one-half of the grain in the ration.

For turkeys, broilers, and layers, wheat can replace one-third to one-half of the grain with no adverse affects on growth and production. Exceeding these limits may result in reduced pigmentation in broilers. On the other hand, for laying flocks, it lightens the color of the egg yolks. resulting in a desirable characteristic.

In formulating wheat rations for all livestock, the quantity and quality of the protein in the wheat should be considered, with the possibility of reducing the supplemental protein accordingly.

Table 7. Approximate Amounts of Western White Soft Wheat Required to Give Nutritional Value When Substituted in the Ration, by Feed and Class of Livestock.[1]

Class of livestock	Pounds of wheat equivalent to 100 pounds of			
	Corn	Sorghum	Barley	Oats
Feeder cattle	95	90	90	80
Dairy cattle	100	100	100	95
Hogs	102	100	90	85
Lambs	110	105	105	100
Poultry	110	110	90	95

[1] These amounts were determined based on data from various sources, including *United States-Canadian Tables of Feed Composition*, National Academy of Sciences, Washington, D.C., 1969; *Doane's Agricultural Report: Reference Volume*, Doane Agricultural Service, Inc., St. Louis, Missouri.

Table 7 gives an indication of the nutritive quality of soft wheat as compared to various feed grains for the different classes of livestock. Many sources were studied in arriving at these estimates. There were several conflicting values, so the estimates presented here should be viewed as preliminary until more accurate data can be obtained.

Table 7 reveals that western white soft wheat is better than corn, sorghum, barley, and oats as a feed for cattle on a pound-for-pound basis, to the extent it can be substituted in the feed ration due to digestibility or related factors. For dairy cattle and hogs, wheat is approximately equivalent to the other grains, and for lambs and poultry it is not as good.

Based on these relative nutritive values, the break-even prices for substituting wheat, presented in Table 8, were calculated. These break-even prices show the economics of replacing the feed grains with wheat in rations for the various classes of livestock.

The ability of Oregon and the PNW to compete with other animal-feeding areas is dependent upon many factors, including:

(1) relative costs of production, including feed costs, nonfeed costs, and marketing costs;
(2) sufficient and dependable supplies of all the required inputs; and
(3) directional flows of animal products in the transportation system, including backhaul factors.

Table 8. Break-Even Western Soft White Wheat Prices to Give Nutritional Equivalent at Various Sorghum, Corn, and Barley Prices

Dollars per ton	Dollars per ton wheat prices when fed to—				
	Feeder cattle	Dairy cattle	Hogs	Lamb	Poultry
Sorghum					
$38.00	$42.00	$38.00	$38.00	$36.00	$35.00
40.00	44.00	40.00	40.00	38.00	36.00
42.00	47.00	42.00	42.00	40.00	38.00
44.00	49.00	44.00	44.00	42.00	40.00
46.00	51.00	46.00	46.00	44.00	42.00
Corn					
$42.00	44.00	42.00	42.00	38.00	38.00
44.00	46.00	44.00	43.00	40.00	40.00
46.00	48.00	46.00	45.00	42.00	42.00
48.00	51.00	48.00	47.00	44.00	44.00
50.00	53.00	50.00	49.00	45.00	45.00
Barley					
$38.00	42.00	38.00	42.00	36.00	42.00
40.00	44.00	40.00	44.00	38.00	44.00
42.00	47.00	42.00	47.00	40.00	47.00
44.00	49.00	44.00	49.00	42.00	49.00
46.00	51.00	46.00	51.00	44.00	51.00

One of the most important of these factors is feed costs and supplies. Under present barley-wheat supplies and prices, the PNW is in a very favorable position relative to livestock feed costs in other regions. For example, in September, 1969, Oregon farm prices for barley were $.85 per ton less than grain sorghum prices in Texas, and Oregon wheat prices were only $1.70 per ton above Texas milo prices. Oregon barley was $1.61 per ton cheaper than Kansas corn, and PNW wheat was only $1.00 per ton higher than Kansas corn. When compared with the substitutability relations described above, it can be seen that the PNW is now in a favorable competitive position for feeding barley and wheat to livestock, and wheat to poultry.

This relation may be only a short-run phenomenon, however, and potentials for increasing livestock feeding in the PNW must be geared to long-run competitive relations. If PNW grain producers are willing to supply adequate tonnages of feed grains at prices competitive with other regions over a longer time span (e.g., 10 years), the potentials for increased livestock feeding are considerable, particularly for cattle and hogs.

Other competitive factors in livestock feeding also should be recognized, even though they probably are not as important as feed costs. Nonfeed costs, including wage rates and death loss due to weather factors, may become significant if feed costs between regions are comparable. Questions also have been raised about the relative efficiency of the PNW meat packing industry; this issue is relevant in determining the ability of the total region to produce meat at competitive prices. In addition, the supply of venture capital for investment in livestock feeding enterprises, whose profitability may be uncertain over time, can be a limiting factor in the industry's growth.

Finally, transportation costs are the equalizer between producing areas and consumer markets. Hence, if production and processing costs are equal in two areas, the area closest to the market should have a competitive advantage. However, the demand by carriers (mainly truckers) for backhaul commodities at very low transport rates tends to complicate the picture.

In general, the competitive position of animal feeding in Oregon and Washington is comparable. Idaho has advantages over these two states in cattle (and possibly hog) feeding due to lower feed grain prices and the availability of large quantities of potato processing by-products which are desirable for feeding. More moderate weather in portions of Oregon and Washington may offset part of this advantage, however.

Potentials for a Feed-Oriented Grain Industry

The previous section discussed the feed grain requirements for livestock and poultry feeding, and the economics of wheat and feed grain feeding in the Pacific Northwest. It was pointed out that, as a short-run situation, PNW wheat has become competitive for feeding to livestock and poultry, but there remained the question of longer-run competitiveness. In this section, the report discusses conditions under which a feed-oriented grain (wheat) industry can develop in the long run.

Agronomic Considerations for New Varieties

One of the first questions deals with the potential for new grain varieties that would encourage feeding. New cereal varieties are constantly being developed by various public agencies and recently by private firms. Until recently, only those varieties of wheat which had acceptable milling qualities were released. Now, with the depressed wheat prices, more interest in feed wheats having maximum yields is being expressed. Morphological identification of feed wheats by either a physical marker such as purple color or by subclass unique to the area is absolutely necessary to preserve the milling market of the area. For example, soft red varieties would be readily distinguishable in the Pacific Northwest. Genetic research aimed at transferring purple coloration to potential feed wheat varieties is now underway. Higher yielding red spring varieties adaptable for feeding are now available, but their milling quality is questionable. From a production standpoint, there is a real place for spring wheats in the rotation both as insurance against winter injury and as a means of controlling cheatgrass and rye.

In order for wheat to be a satisfactory feed grain, it must be available in large quantities at prices equal to or lower than other commonly used cereals over a long period of time. Wheat breeding programs have previously concentrated on selecting only those varieties which have satisfactory milling and baking qualities. If potentially higher yielding wheat varieties are to be made available, they must be capable of segregation from food varieties in the market.

Wheat has a historical reputation as a source of lysine, an essential amino acid. Recently, considerable interest has been shown in improving the lysine content of wheat for non-ruminant livestock feed and for food purposes where wheat is the major source of protein. Ultimately this may be possible, but the genetic control of this amino acid production has not yet been thoroughly studied. In the interim, lysine shortages can be best overcome by selection of higher protein varieties and/or supplementation with other feeds.

Hull-less barley varieties have higher protein and also higher lysine values than conventional barley varieties. They potentially could provide better sources of lysine than either wheat or conventional varieties of barley when used for poultry or swine rations. Much additional agronomic and nutritional work is needed before these varieties become commercial realities.

Recent discoveries of high protein oat lines have caused a renewed interest in this crop. Whether it could ultimately be useful in the Pacific Northwest will be determined by the competitive yielding ability of such high protein lines under our marginal oat growing conditions.

Much popular treatment of Triticale has been given in recent years. These crosses between wheat and rye have morphological characteristics most similar to rye. Generally the product does not mill satisfactorily, hence it is most often considered for livestock feed. Its protein content is higher than other cereals, and once agronomic improvements can be made in the crop it might become an important source of high-energy, high-protein livestock feed.

While in the short run some questions remain about the adaptability of existing varieties of grains to be grown as feed grains in the PNW, there are no questions of the ability of geneticists in the longer run to develop grains having an advantage for production as feed grains. For this to occur, there must be an indication of the feasibility of a feed-oriented wheat and feed grain industry capable of competing with feeds produced elsewhere.

Effects of Wheat Exports on Feed Use of Wheat

The United States has been a net exporter of wheat and feed grains since at least 1910. These exports have been a source of foreign exchange and have enabled the development of a stronger national agricultural economy. So long as the U.S. continues to sell grain in export markets, internal pricing relationships reflecting transportation costs will exist. In the long run, prices of grains at points of export such as Pacific Northwest terminal markets will be higher than in centers of production such as the Great Plains by an amount equal to the net transportation costs between the areas.

The relationship between the export market and utilization of wheat for feed would appear to be clearcut: they are directly competitive. But this statement is only partially true. Because there is significant excess capacity to produce wheat in the PNW, the industry would be capable of maintaining exports and could concurrently increase production to supply significant quantities to the feed grain market. The reason this is not being done rests with the government wheat programs that have restrained production by removing wheat acreage. To some extent, however, the effects of government wheat programs have been offset by increases in feed grain production which have entered both the domestic and export markets.

There is one point about the relationship between export markets and feeding that deserves further investigation. At present the wheat marketing system in the PNW is oriented toward exporting. Wheat tends to move into locations in preparation for export. This may cause it to be unavailable for feeding in areas where it is produced even when it is priced competitively with feed grains. In addition, many growers obtain government loans and store their wheat. When this happens, the wheat is withdrawn from the feed grain market, and often for an extended period.

From the individual grower's standpoint the final use of wheat is not as important as the return he receives. In recent years the export market has offered higher returns than the domestic feeding market.[11] Nevertheless, during the past 2 years the export market has shown signs of weakening. Whether this weakening will continue is significant. In brief, it looks as if the PNW would be able to both meet its export demand and at the same time provide substantial quantities for feeding purposes over the next decade. Whether this occurs depends on the nature of government commodity programs and the extent to which producers shift to alternative enterprises.

Impact of Commodity Price Programs on Feeding of Wheat

Since major farm program legislation expires with the 1970 crop, any discussion about the effects of future farm programs on livestock feeding would of necessity be clouded by uncertainty. In general, two major alternative approaches are being proposed for the 1970's.[12] The first is a program that would retain the basic features of the 1965 Food and Agriculture Act; namely, (1) voluntary rather than mandatory participation, (2) relatively low price supports to discourage expanded production and encourage greater utilization in both export and domestic markets, (3) direct income payments (like current "wheat certificates" and "diversion payments") to supplement incomes of participating farmers and encourage participation, and (4) reliance primarily on (partial-farm) annual acreage diversions to control supply. The second major proposal would phase out the current commodity programs over a period of years and replace them with long-term retirement of whole farms as a method of limiting total farm production.

With either major proposal, it appears that the resulting price of wheat relative to feed grains will be low enough to encourage greater utilization of wheat for feed nationally. This was the effect of legislation first adopted for the 1964 wheat crop and later incorporated in the 1965 Act. During the 1950's and early 1960's when high price support policies were followed, the price relationships were such that wheat was effectively priced out of feed grain use (see Figure 2).

If the 1970's continue the trend established in the mid-1960's of lower wheat prices relative to feed grains, *this should encourage greater livestock feeding in areas like the Columbia Basin where wheat is the major crop.* This trend should also dis-

[11] This has been due in part to the operation of government wheat programs which are discussed later.

[12] There are, of course, numerous proposals. Four are discussed in "Farm Programs for the 1970's," CAED Report No. 32, Iowa State University, 1968.

courage wheat production in other areas where environmental conditions permit other, more profitable crops to be grown.

Broadly speaking, policies (either Federal or efforts on a regional basis) to *stabilize competitive* price relationships would contribute to an expansion of livestock and poultry production. Policies that could provide competitively priced feed grains during temporary periods of unusually high price conditions in the PNW include:

(1) Stabilization stocks held in the PNW for the purpose of maintaining stable grain prices (the same stocks could also be used as strategic reserves)

(2) Emergency freight rates on feed grains from other producing regions

(3) Flexibility of Federal farm programs to allow regional variation in acreage allotments for the purpose of restoring depleted stabilization stocks in some regions.

So far the importance of relatively low *market* prices on a continuing basis has been emphasized. Whether such conditions will exist depends in large measure on future Federal farm programs and the export situation for wheat.

Another potentially feasible approach that could be achieved outside existing farm programs would be to *subsidize* the utilization of "excess production" of PNW grains for feeding. The objective here would be to avoid the accumulation of stocks which tend to depress prices in subsequent years. Such a program could be operated by producer or marketing organizations and presumably would operate in such a way that larger quantities would be subsidized in unusually good crop years than during less favorable years. This irregular feature, if it were followed, would probably not encourage the expansion in livestock and poultry feeding that would be obtained if the objective was to subsidize more or less regular *quantities* from year to year. Nevertheless, this proposal could at a minimum displace shipped-in feed grains in favorable PNW crop years, and thus avoid stock accumulations. If operated to subsidize and stabilize regular quantities, the proposal could encourage an *expansion* in livestock and poultry feeding.

Some Quality Considerations in Marketing Northwest Wheat

The greatly increased level of world wheat supplies has changed the comparative advantage between world suppliers and buyers of wheat. As a result, buyers have been able to exercise greater influence on quality specifications on wheat purchases, particularly on U.S. cash sales to Asian markets. At the same time, Australia and Canada have become more aggressive in efforts to export wheat, and have improved the quality of their offerings to the cash buyers of U.S. wheat. Quality considerations that once were of only secondary importance have loomed to be an important variable, next to price, for continued export sales. In addition to the large world supply of wheat which permits cash buyers to become more selective, the increased sophistication of the use of wheat has affected both the quality and type of wheat demanded.

The ability of cash buyers to specify quality standards for PNW wheat is expected to continue, consistent with continued large world supplies. But even beyond the supply aspect, the continued upgrading in the use of wheat by Asian countries is expected to increase the relative importance of quality.

Importance of Protein Levels

The question of quality became particularly important in the 1968-69 marketing year, when cash buyers demanded lower protein white wheat than had been offered by PNW shippers, charging that protein content had increased over a several-year period. To meet the demands of foreign buyers, and to weaken the threat of other producing nations to U.S. markets, a regional wheat quality survey was established for the 1969 crop.

The objective of the program is to provide, on a weekly basis, reports on protein content, mois-

ture content, test weight and all grading factors, and Alpha-Amylase content (Swedish Falling Numbers Method).

To aid country elevator operators in segregating wheat by protein levels by visual observation, kits containing samples were distributed widely in 1969 prior to the harvest season. During the harvest season a few operators did segregate wheat by protein content, but in general their efforts were not profitable since neither an advantage in sales nor prices were received for the added costs involved. However, in the 1969 Quality Survey, protein content, Alpha-Amylase activity, moisture content, and all grading factors were excellent.

While it is commonly conceded that the PNW wheat industry can segregate wheat by protein levels, this practice has not yet been used by foreign purchasers of wheat. The world's excess supply of wheat relative to effective demand undoubtedly has given cash buyers an opportunity to "play the market," but such purchase strategies do not necessarily advance quality standards without an incentive that is equally acceptable to buyers, traders, and industry—and to producers. Despite the substantial innovations developed for the marketing of other commodities, wheat by contrast remains surprisingly unsophisticated.

There is little forward buying of spot grain in advance of the growing season as exists for some crops, by which a producer can use cultural practices to modify or influence quality. Buyer specifications for type and variety are not made prior to planting. Conflicts may occur in objectives of those who service farmer's fertilizer requirements and those who market wheat, even when these activities may be carried on by the same company.

Grading

Present grain grading methods do not fully describe the quality of Pacific Northwest white wheat. Cooperative investigation of this problem needs to be supported both domestically and by our Asiatic cash customers. In the interim, specification for more accurate description of defined qualities would assist the steady marketing of our crop.

The present U.S. grade standards are based upon a system organized in 1916. Original criteria for grading wheat were physical determinations, contamination, test weight, and subclasses based on ultimate use of the product. These standards have been modified from time to time and are still serving as useful aids in marketing at the national level. Many domestic transactions are using additional criteria in describing the product. If these factors are useful to both the buyer and seller, then steps should be taken to make them a part of the standards. In similar fashion, some present factors used in the standards may be serving no real purpose. Test weight may not be as highly correlated with flour yield as kernel weight or kernel shape. Protein content is used in nearly all domestically milled wheats, yet is not a factor in the current grades. Simple milling tests and chemical tests which predict ultimate baking performance have been developed and would be desirable, especially to the wheat processor.

In foreign trade, U.S. wheat is often considered substandard because of high tolerance of foreign material in the individual grades and because of the 0.5 percent tolerance of dockage. These criticisms could be avoided either by alterations of the standards or by making efforts to encourage more distinctive contacts for foreign shipments. Pacific Northwest produced wheat is drier than most other wheat in the world because of normal weather conditions at harvest time. This low moisture is of distinct advantage to millers because of weight gains during normal tempering procedures, yet currently no distinction for this extra characteristic is being made.

Cultural Practices

Time of planting, depth and rate of seeding, soil moisture, and temperature are some factors that may influence protein content. For soft white and white club varieties protein content is also related to nitrogen fertilization rates. Optimal fertilization rates balanced to available soil moisture and yield will normally produce wheat protein levels from 9 percent to 10 percent, which are in the acceptable range for these wheats. Maximum yields, which are usually not economic, resulting from excessive fertilization consist of protein levels in excess of 10 percent. Consistent protein levels below 9 percent indicate that a given farm could expect to obtain an economic return from additional increments of nitrogen fertilizer. Generally the protein content of white wheats grown in the Columbia Basin increases with later seeding dates.

Some Production Adjustments and Alternatives

Given the conditions of world supply and demand for wheat and other grains, and requirements for a feed-oriented wheat industry, what are some alternatives facing individual wheat farmers? It appears that no one alternative has uniform potential for the entire region. And so, there are individual choices to be made, and for some, there may be no feasible alternative to present production programs. In this section, attention is given to some identifiable alternatives for the producer's consideration.

Shifts to Hard Red Winter Wheat

Recent premiums on hard red winter wheat in Portland have prompted growers' interest in the production of these varieties. Use of the present hard red winter varieties could produce *quality* and *yield* competitive with soft white or white club on an estimated 120,000 acres in Oregon. These production areas are in western Umatilla, northern Morrow, northern Gilliam, southern Wasco, and southern Sherman counties. There are also some dry land areas in Klamath, Jefferson, and Lake counties which produce satisfactory quality hard red winter wheat. The environmental conditions necessary for high-protein production are those which induce a physiological drought shortly before maturity.

Competitive yields of red wheat can also be produced in other areas, but protein content usually drops and the long-term marketing possibilities are diminished.

Hard red spring varieties could be of real importance in Klamath and Jefferson counties. Additional work with these potential varieties is planned for the Columbia Basin area.

Use of heavy amounts of nitrogen fertilizer can increase protein values.

More cultural information on time of planting, rate and depth of seeding, and their effect on protein content is needed. This information has been assembled from all commercial 1969 production and will be related to both protein content and milling quality.

The Relative Profitability of Wheat and Barley

In many Columbia Basin areas, the cost of producing a ton of barley and a ton of wheat are approximately equal under present technology. This varies somewhat from one region to another; conditions in some regions may be more favorable for barley and in others for wheat. It also varies over time because improvements in production technology may be more rapid for one crop than the other.

If costs per ton are the same, then the relative profitability depends on the prices at which wheat and barley can be marketed. During periods when wheat can be sold for more than barley, wheat will be more profitable. In the past, wheat prices have normally exceeded barley prices and so wheat would be planted up to the maximum permitted by Federal programs. During recent years, however, the price relationships have tended to equalize for wheat and barley (primarily because of changes in Federal programs) and also programs have permitted growers to plant wheat in place of barley under the substitution clause. Consequently, the economic advantage of wheat over barley has been reduced if not eliminated for many farm situations under these conditions.[13]

The Economics of Increased Livestock Production In the Columbia Basin

This section analyzes the economic feasibility of marginal shifts toward livestock production on individual wheat farms in the Columbia Basin of Oregon. Before any analysis can be made, it is necessary to take account of the present situation in this area with regard to livestock production.

A 1965 survey in Wasco, Sherman, Gilliam, Morrow, and Umatilla counties revealed that 58 percent of the wheat farmers in this area had cow-calf enterprises at that time.[14] A recent examination

[13] There is still an incentive to grow wheat to maintain acreage allotments and remain eligible for future program benefits.

[14] C. K. Gee and H. H. Stippler, *Cow-Calf Enterprises on Wheat Farms in the Columbia Basin of Oregon,* Special Report 242, Agricultural Experiment Station, Oregon State University, Corvallis, Oregon, (November, 1967), p. 1.

of the numbers of cattle reported on farms in this area indicates there is no reason to suspect any significant change in this percentage. Figures for 1968 show that there was almost one beef animal for every three acres of wheat harvested.[15] The value of cattle and calves sold actually exceeded the value of wheat sold by these counties in 1968. (Of course, wheat prices and yields were unusually low in 1968 and cattle prices were relatively higher.) There were over 23,000 hogs on farms in these five counties in 1968.[16] From this, it appears that a substantial segment of the agricultural resources of the Columbia Basin are already allocated to livestock production.

In past years, the cow-calf enterprise on Columbia Basin wheat farms has been characteristically small and supplementary in nature. Predominantly these cow herds were found to be under 70 head in size.[17] The cow-calf enterprise was supplementary to the wheat and barley enterprises, utilizing resources that would otherwise be unemployed. The cattle were grazed on range consisting of canyons, hills, and nontillable areas scattered among grain fields. Aftermath grazing also contributed to the feed supply. Another common practice was to overplant wheat allotments and then cut the least productive excess areas for hay. The annual work schedule on the farm could be adjusted to permit the timely performance of most tasks involved in both the crop and cattle enterprises.

Range was found to be the major investment item. However, when one considers that there are few alternative uses of this resource, or possibly none at all, the opportunity cost of its allocation to beef production is low. The few buildings used for livestock, while generally well kept, represented low investments per cow.

The returns to family labor and management and the returns on investment were calculated based on average prices for various farm situations. Returns to family labor and management were negative in all cases except the small cow herd on large farms. The same tendency was observed for returns on investment. The small herd on large wheat farms yielded the highest rate of return, 5.3 percent.[18]

With higher wheat prices, the cow-calf enterprise could not profitably compete for resources devoted to wheat production. This explains the greater profitability of the smaller cow herds on the larger farms. These enterprises were supplementary, utilizing resources which could not be employed in crop production.

As the cow herd became larger in relation to farm size, the cow-calf enterprise was competing for resources which could be more profitably allocated to crop production during those years. The result was a lower return on investment in cattle production.

Given this background, the question now becomes one of the economic feasibility of shifting resources from wheat production to livestock production in view of the possibility of continued low wheat prices in the future. A recent study of Eastern Washington wheat farm organizations provides some insights into the profitability of adding livestock enterprises when wheat prices are low.[19]

This study explored the impacts on net farm income of adding livestock enterprises to existing individual representative grain farms at various wheat price levels. The representative farms analyzed are similar to those in the Columbia Basin of Oregon. The study allowed for the addition of both cattle and hog enterprises. When feed purchase was restricted, livestock added little to net farm income until the farm wheat price was well below $66 per ton. At the lowest levels of wheat price ($35 to $38 per ton), net income added by livestock ranged from $2,000 to $5,500, depending on the farm organization.[20]

Cattle and hogs were equally profitable uses of idle family labor when the wheat price was between $50 and $66 per ton. However, neither use could compete effectively for family labor with

[15] *Oregon Commodity Data Sheet: Cattle,* Cooperative Extension Service, Oregon State University, Corvallis, Oregon, (June 13, 1969); and *Oregon Commodity Data Sheet: Wheat,* Cooperative Extension Service, Oregon State University, Corvallis, Oregon, (September 25, 1969).

[16] *Oregon Commodity Data Sheet: Hogs,* Cooperative Extension Service, Oregon State University, Corvallis, Oregon, (May 22, 1969).

[17] Gee and Stippler, p. 1.

[18] Gee and Stippler, p. 17.

[19] E. E. Weeks and I. D. Branson, *Addition of Livestock Enterprises to Selected Eastern Washington Wheat-Summer Fallow Farm Organizations,* Agricultural Experiment Station, Washington State University, Pullman, Washington, (September, 1967).

[20] *Ibid, p. 1.*

crops. Hogs appeared to have a profit advantage over cattle at lower wheat prices and cattle over hogs at higher wheat prices.

The addition of livestock under different wheat prices affected family labor returns and utilization.[21] Family labor was utilized at levels of 25 to 50 percent when no livestock were on the farms. This increased to 75 to 100 percent with the addition of livestock. At wheat prices above $50 per ton, family labor employed in livestock production returned between $0.60 and $1.00 per hour. This return is quite low considering that no charge was made for capital. However, with wheat priced at $46 per ton, the return per hour of labor increased to approximately $1.50.

The results of this study show that the higher wheat price of past years explains, at least in part, the relatively low level of livestock production on wheat farms. At higher price levels, livestock cannot compete with crops for labor. With lower wheat prices, cattle production and also swine production become more profitable uses for family labor. It should be noted that a 2-year income lag would normally exist for shifting from wheat to cattle. Also, such a shift would require an explicit commitment to the livestock enterprise, because of its long-range nature.

From this analysis, it appears that livestock production may be a promising alternative for some Columbia Basin wheat farmers given the present and future outlook for wheat. However, there are several questions that remain unanswered. These include:

1. What type of livestock production enterprise should be added to provide the highest farm income? Should it be a cow-calf operation, a yearling operation, a beef feeding operation, a sow operation, a hog feeding operation, or a combination of these? What about fall calving?
2. The addition of livestock to the farm organization will involve a larger capital investment. How should this be financed?
3. Can livestock producers in the Columbia Basin compete economically with producers in other regions over the long run? How will increased production in the Columbia Basin affect the profits of producers in other areas?

[21] *Ibid, p. 1.*

Irrigation Development Potential

The potential for much greater irrigation development in Oregon Columbia Basin counties can be expected to have an impact on wheat production in this area. In some instances irrigation is taking land out of wheat production and offering the operator an alternative to produce other crops. In other cases this water is being used to irrigate wheat. The resulting increased wheat yields usually more than offset any reduction in wheat acreage, with a net increase in total wheat production in the area. In intensive irrigation crop rotations, a cereal crop such as wheat may be necessary for pest control or to improve soil conditions.

At present there are several proposed federal and private irrigation projects in the Columbia Basin area. Some of these projects, if constructed, would provide irrigation water for land now devoted to wheat production. For instance, the Umatilla Basin project which is currently under study by the U.S. Bureau of Reclamation would provide irrigation water to some 102,000 acres of dryland in Umatilla County, most of which is now in wheat production.

High-lift irrigation is becoming more economically feasible and may bring other land currently poducing wheat under irrigation. Just a few years ago lifts of more than 100 feet were the exception, today lifts to 500 feet are possible.[22]

Various research investigations that are under way today can have considerable influence on the rate and location of irrigation expansion tomorrow. Included is current research regarding irrigation and soil heating as a by-product of nuclear reactors and using cooling water through sprinkler irrigation to control stream pollution. Adoption of these concepts may change the competitive position of the Northwest relative to other areas and provide the spring-board for developments not now visualized as being sufficiently feasible to stand alone.

Although many wheat producers will not have irrigation as an alternative in shifting land use, a significant number may have this alternative in future years. More research regarding feasibility of irrigation development and irrigated crop poten-

[22] "Future Irrigation Developments and Power Requirements in the Northwest," presented by Marvin N. Shearer at the Northwest Public Power Association annual Power Use Conference, Moses Lake, Washington, September 11, 1969.

tial in the Columbia Basin area could materially assist in this transition.

Potential development of irrigation projects in the Columbia Basin has led to speculation of the potential for vegetable crop production for fresh and processed market outlets. From a horticultural point of view, no conclusive evidence of widespread vegetable crop adaptability to this region exists. Research has been underway for several years at each Experiment Station in this region with a number of crops, including tomatoes, sweet potatoes, potatoes, snap beans, lima beans, dry beans, onions, sweet corn, peas, watermelons, safflower, mint, alfalfa, soybeans, and other crops. Preliminary evidence suggests some of these crops *may* be made adaptable to the climate and growing conditions of these regions. However, adaptability alone is not a satisfactory basis for development of a new industry.

For the most part, there is no shortage of vegetable crops grown in Oregon for processing; in fact, there is at present an excess capacity at the farm production level for all vegetable crops. Thus, development of new regions must occur by a transfer of production from (1) existing regions in Oregon, or (2) less advantageous producing regions outside Oregon.

A combination of factors must be favorable for this to develop. Some refer to these factors as the "critical mass," which includes personnel, management, capital, entrepreneurship, markets, etc. The most critical need, of those listed, is access to a well-developed market, by a firm with a history of success.

Sizable increases of acreages of potatoes and alfalfa hay are occurring despite the foregoing limiting factors. Production from these agronomic crops is being channeled through existing markets. Ultimately this production may at least partially replace production from other marginal areas.

There appears to be a growing but limited export market for dry beans produced in this area. This crop can be partly handled with existing dry land wheat farm equipment and will probably become important, especially in the years of transition from dry land to more intensive irrigation farming.

Intensive forage and feed grain production might be feasible in an integrated livestock economy. Net beef production from irrigated pastures has ranged from 650 to 900 pounds per acre. Alfalfa yields of 9 tons per acre are possible. Feed wheat, field corn, and corn silage would complement the regional livestock feed situation.

The advantages of Columbia Basin areas over existing producing areas as yet have not been demonstrated. Over a longer period of time, these possibilities need to be the subject of horticultural and economic research, in a coordinated pattern, to help bring about whatever adjustments are economically sound.

Alternatives for Increasing Returns to Wheat Farmers by Group Negotiation

Bargaining Power: Bargaining Associations

Producers of numerous specialty crops have formed bargaining associations to improve returns by negotiating with buyers on prices and other terms of trade. For the most part, bargaining associations have achieved modest success in increasing the incomes of their producer members.

Common characteristics that apply to most successful bargaining groups include:

1. Getting buyers to recognize the association as the bargaining representative of farmers. In turn, this requires binding contracts with farmers who produce a large enough supply of the product to force recognition if necessary. The bargaining association must have the power to inflict economic pain on those with whom it deals, whether or not it actually uses this power.
2. Increasing consumer demand for the commodity.
3. Few close substitutes for the product under consideration.
4. A limited production area, or absolute comparative cost advantages over other production areas.

5. A cohesiveness of group action, and the ability to maintain unity during difficult times.

Most characteristics of the wheat industry go contrary to the elements necessary for successful price bargaining. Product demand is not expanding, production is geographically widespread, there are good substitute products for secondary uses of wheat, and wheat farmers, except possibly for political activity, have not shown much united action. With new milling technology, even distinctiveness of product use is disappearing.

In practice, bargaining associations encounter considerable dilution of power because of additional supply from existing (member and nonmember) producers and from new producers. Acreage allotments provide some outside limits to supply response in wheat, but new varieties and improved cultural practices can result in higher production despite acreage restrictions. To more effectively influence supply a bargaining association would have to impose and enforce its own production or marketing allotments that would be somewhat less than government allotments.

As stated earlier, demand conditions, nonmember supply response, and share of production controlled all influence a bargaining association's ability to enhance price. It is estimated that a bargaining association must control at least 58 percent of total production to successfully enhance prices, and members of the association must be prevented from increasing their production. It is questionable whether a bargaining association can successfully control this quantity of wheat on a national basis. And if it did, it would actually decrease U.S. exports because other nations would compete at the higher prices.

Bargaining associations normally negotiate at the first-handler level. Because of the integrated system at the country and terminal elevator levels and the large number of elevator units, bargaining with these firms over price would be difficult. Therefore, if wheat farmers take to bargaining for price, the logical points are at the relatively concentrated and profitable levels of flour milling and wholesale baking. Whether a bargaining association can gain recognition to bargaining for wheat prices at points removed from the handling of the basic commodity is debatable, however.

Market Power: Vertical Integration

Operating cooperatives are a type of vertical integration practiced by many agricultural producers. The handling and storage levels for wheat are quite competitive, so that further integration at these levels may give farmers a somewhat greater voice in the market, but perhaps no substantial increases in their net income.

Successful integration into exporting on a large and significant scale would virtually require the acquisition of one of the largest integrated exporting firms. An investment of between 33 to 50 cents per bushel of wheat handled by all U.S. farmer wheat cooperatives would be required, depending upon which of the largest firms would be available for acquisition. Assuming an average yield of 40 bushels per acre, an investment of between $4 and $6 per wheat acre would be required, and returns from 5 to 15 percent after taxes, or between 17 to 50 cents per ton might be expected.

Excess capacity, inefficient operations, and moderate profits from flour milling indicate a dubious advantage from integration into flour milling at this time. Excess capacity in 1963 was 7.4 percent, and it has been declining at an average rate of .3 percent a year since 1961. However, a number of milling companies have closed country mills since that time, such as General Mills' closure of nine flour mills in 1965, so that excess capacity is now less. Some mills which sold at low prices have produced higher than normal industry returns on investment to new owners. Nevertheless, flour milling is assumed to be highly competitive, and many firms rely on complementary operations, such as feeds, for profits. Profitability may improve as more firms close inefficient mills and use the most recent technology.

While farmer cooperatives have integrated to a very small extent into the flour milling industry, they are not integrated at all into wholesale bakery operations. It would take an investment of the magnitude required to purchase one of the four exporters if farmer cooperatives as a group were able to acquire the assets of one of the major wholesale baking firms. Such an investment could yield returns of from 20 to 60 cents per ton to farmers, after taxes. Thus, the vertical integration route requires considerable investment, and in final analysis, net returns for a wheat grower with 500 acres

of wheat, and averaging 1.2 tons per acre, would total between $1,000 and $3,600 annually, depending upon the profitability of the flour milling firm or wholesale bakery acquired.

The potential for PNW wheat producers to increase their economic strength through bargaining power, given the present economic and political environment, is not optimistic.

Industrial Alcohol from Wheat

Currently there is substantial interest in the possibility of using ethyl alcohol as an additive in fuels for internal combustion engines. By eliminating the need for the tetraethyl lead additive currently used in automobile fuels, the use of ethyl alcohol would eliminate one component (lead) of air pollution. It could also have other favorable effects on air pollution. More research is needed on this latter point, however.

Ethyl alcohol is produced through two major procedures. The first is a *fermentation* process which utilizes the following raw materials: cereal grains, sugar cane, sugar beets, fruit product wastes, potatoes, and wood-cellulose materials. Ethyl alcohol is also produced by *chemical synthesis* from petroleum and natural gas, coal, oil shales, and sand. More than 93 percent of ethyl alcohol produced in the U.S. is prepared from cereal grains and petroleum-based raw materials. Chemically, synthetic and fermentation alcohol are identical.

By law all beverage alcohol in the U.S. is produced by the fermentation process. About 130 million bushels of grain (mostly corn, rye, barley) are used annually in this market. Nearly all industrial alcohol is produced by chemical synthesis from petroleum because it is less expensive.

At present very little wheat (less than 3,000 tons grain equivalent annually) is used for alcohol, even though during World War II about 7.5 million tons were converted to alcohol. Although wheat is a suitable raw material technically, it is more expensive than other sources for fermentation. Estimates of the net costs of fermentation (allowing a by-product feed credit of $50 ton) would be 18-21 cents per gallon. Wheat priced at $50 per ton would add another 58 cents per gallon.[24]

Comparable costs for chemical synthesis range from 31-40 cents per gallon depending on the price of the raw material. Under current technology for fermentation, wheat would have to be priced at $17 per ton to be competitive as a source of industrial alcohol.

Currently the market for industrial alcohol is equivalent to between 100-125 million bushels of wheat; this market has been stable for several years. There is no foreseeable shortage for synthetic alcohol. However, if ethyl alcohol were to become an additive for gasoline, the market would grow manyfold. If the total alcohol required were from fermented grain, a total of 3.2 billion bushels of grain would be needed to produce a 10 percent blend for the gasoline used annually in automobile fuels alone. This compares with a 1968 U.S. cereal (wheat, corn, sorghum) production of 6.7 billion bushels. If such a transformation occurred, the U.S. would face a shortage of carbohydrate energy for food and feed; a surplus of protein concentrates might develop in this hypothetical situation because of the production of high-protein by-products from the fermentation process.

Because of current adequate petroleum supplies in the world and because ethyl alcohol can be produced from petroleum at about 50 percent of the current cost of production from wheat (valued at $50 per ton), it does not appear that large-scale production and use of fermentative ethyl alcohol will occur in the immediate future. In order for this to occur, the conversion costs of cereals would have to be reduced through improved technology.

[23] This section is based primarily upon a paper by Dwight L. Miller, assistant director, North Regional Research Laboratory, ARS, USDA, Peoria, Illinois. The paper was presented at the Sixth National Wheat Utilization Conference, Oakland, California, Nov. 5-7, 1969.

[24] Estimates given in D. L. Miller report, Tables 2 & 3, p. 16.

There is some possibility of using ethyl alcohol produced from grains on a state or regional basis where the current price of protein feed supplements is high relative to other regions. Based on economic feasibility, mandatory legislation will be required to obtain a market outlet for cereals through this use.

Although the economic feasibility of converting wheat to ethyl alcohol for automobile fuels does not appear especially bright at present, the work of Oregon wheat growers in exploring this potential should be encouraged. They are focusing attention on the serious problem of air pollution. They are recommending an alternative which may eventually prove to be feasible and desirable.

There are several areas in which additional research is needed:

1. The effect of gasoline-alcohol fuels on components of air pollution in addition to lead. Their effect on the antipollution devices that are presently required, or that will be required in the future, as equipment for internal combustion engines.
2. Possible new technologies that could reduce the cost of converting cereals to alcohol and improve the quality of by-products.
3. The market potential (domestic and export) for the high-protein by-products of the fermentation process.

Conclusions and Recommendations

Fundamental decisions are required from all sectors of the wheat industry—producers, the grain trade, and government agencies—for the Pacific Northwest's wheat industry. The optimism of a few years ago based on an expanded world demand for wheat has now been replaced with almost an equal amount of pessimism. The expected markets did not materialize, while world wheat production increased substantially. India and Pakistan, large outlets for PNW wheat, reached some level of internal balance with wheat. It is too early to be certain whether this purported self-sufficiency by these nations will be temporary or permanent. The fact is that world wheat supplies of all classes far exceed quantities demanded at prices considered reasonable by producing regions. In view of these and other facts and situations presented in the main body of the report, the following conclusions and recommendations are presented for consideration:

1. The PNW has largely relied on export sales (cash and concessional) for a large proportion of its production. Wheat from this region is facing increased competition from foreign producing countries, as well as shifts away from soft white wheats as consumer preferences change.

In view of this, more emphasis is recommended to obtain long-run export market intelligence by detailed studies of trends and policies in major grain exporting and importing countries, with special emphasis on Australia, the European Common Market, and Asian countries.

In addition, a unified program for revision of U.S. Grain Standards should be supported by the entire PNW wheat industry to better meet foreign competition in export sales.

2. Livestock and poultry feeding is a potential growth area for use of wheat and other cereals grown in the PNW. The industry must decide whether it can and wishes to produce cereals for a livestock-oriented industry over a long period of years.

The wheat industry should examine the changes that will be needed in market information and in the marketing system, if the PNW grain industry becomes more dependent on livestock and poultry feeding as a market for grains.

Substantial increases will be required in investments in cereal breeding programs to accelerate the development of high-yielding, nutritive feed grains. Such increased investment should be made only after a commitment and support by the wheat industry.

To assist the industry in reaching this commitment, additional research and educational support is needed to appraise the profit potential of livestock production alternatives on marginal cropland

in the Columbia Basin of Oregon. The potential for increasing livestock production other than livestock feeding should be given consideration.

The wheat industry and educational and governmental agencies are urged to explore methods of stabilizing adequate supplies of feed grains at prices competitive with other feeding areas. Substantial increases in livestock feeding will not be feasible without this long-run stability.

3. Existing and pending irrigation developments in the Columbia Basin will create incentives and pressures for shifting to more intensified cropping patterns. Problems of technological feasibility need to be supplemented with economic feasibility analyses if full development potentials are to be amassed with a minimum of adverse effects. Mostly, a transitional agriculture is envisioned, moving first into more intensified *field crop* production until market demands expand and/or interregional competition studies show the potential for success in *vegetable crop* production for processing on a larger scale than now exists in this region.

With the long run in consideration, genetic development of varieties of Oregon's main vegetable crops grown for processing should be a sound investment. The development of varieties of desired quality characteristics that are adapted to soil and climatic conditions of the Columbia Basin should be considered. It is acknowledged that this is more than a problem of the wheat industry alone; support must be generated on a regional basis broader than agriculture alone.

4. Federal farm legislation has been an important feature of the wheat industry for many years. While specific provisions for farm legislation may vary over time, it is expected that federal legislation will continue to be important to the PNW wheat industry.

When new farm legislation is approved by the U.S. Congress, its implications should be intensively examined by industry task forces. Emphasis should be given not only to the impact on individual farm situations, but also for the PNW region as a whole, with special attention to the effect of the programs on a) production, exports, and feed use, and b) public and private storage operations in the PNW.

5. The existing marketing system has changed only slightly over a 50-year period, except for additional facilities added at various levels of grain handling. The industry needs to evaluate the need for and costs of maintaining existing facilities, and to determine whether efficiency and increased returns can result from developing a wheat handling and marketing system more in line with technological developments and organizational procedures used by other industries.

6. Group negotiations by wheat producers is not a realistic alternative for improving incomes of wheat farmers, because of the reliance of the PNW wheat industry on foreign markets. The IGA was intended to serve a somewhat similar function at the international level, but its effectiveness in view of existing world production is now debatable. Integration by producers into the flour milling or export trade is likely of questionable potential.

7. More research is needed to determine the effects of gasoline-alcohol fuels in abating automotive air pollution, and the economic aspects of converting wheat to alcohol and its by-products.