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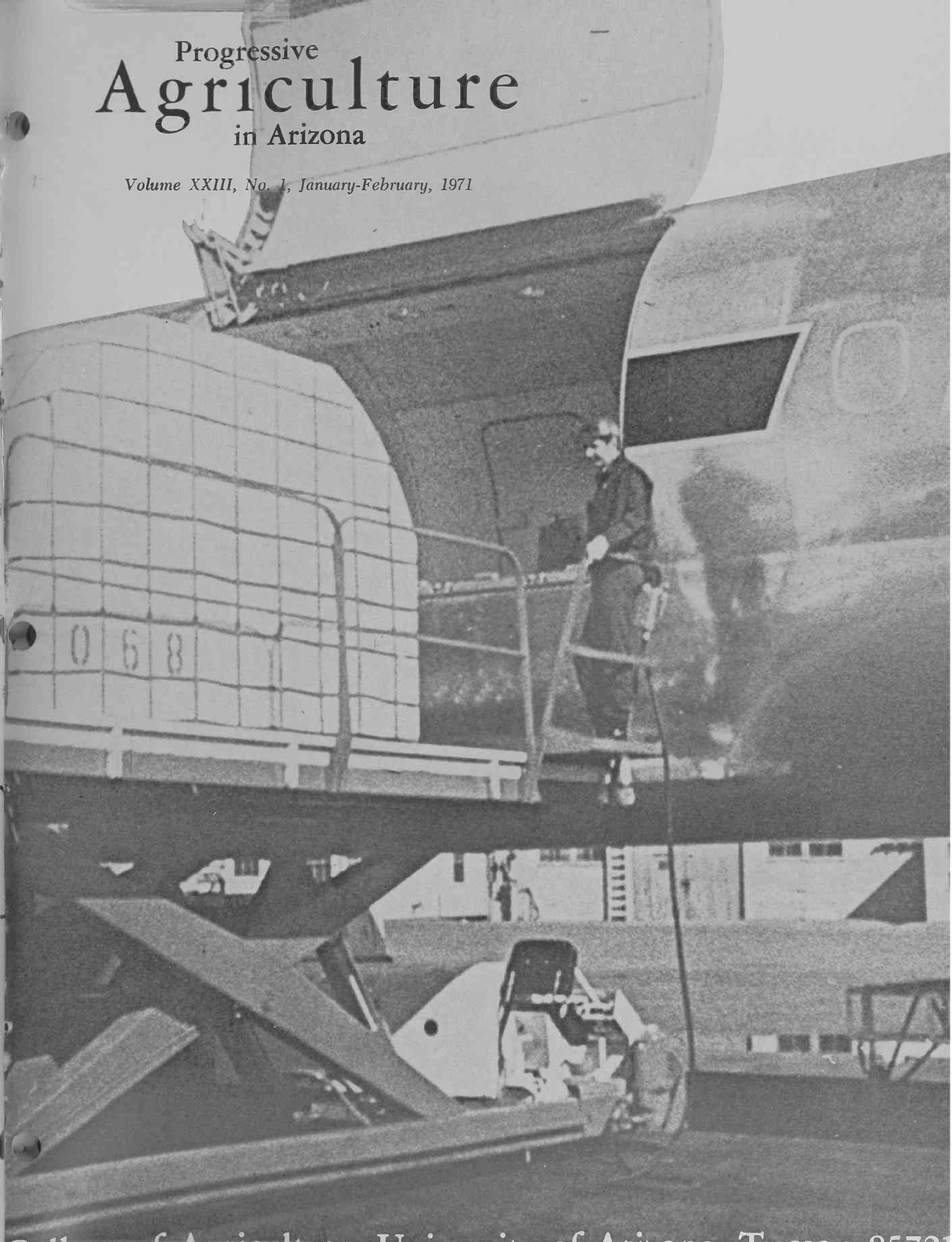
in Arizona

Volume XXIII, No. 1, January-February, 1971



College of Agriculture, University of Arizona, Tucson 85721

Return of the "E" Flags

"E" flags are again flying over our nation.

The E flags wave from many articles whether in newspapers or magazines; on radio or television; or as a part of speeches signaling concern about E-cology and E-nvironment.

The old E flag awards were proudly raised during World War II to proclaim to all beholders the achievement of a production efficiency against a common enemy. Today's E flags trigger concern over the future well being of mankind which may result in worry, suspicion, guilt or fear.

And, as the present-day E flags flutter in the breeze they seem to indicate a desire for change. These moments seem to come periodically, without pattern, create great excitement among the citizenry and eventually whirl away, leaving behind only a few signs to mark their passage.

There are exceptions, naturally!

The desire to change appear to be related to some concern over man's survival. It seems likely that our system, or life patterns, will be changed because of this concern particularly if certain segments panic in face of the clamor.

Some have questioned the application of science and technology to achieve an efficient agriculture. They imply that to do so creates a regressive effect on the environment. That is, the greater the technology and efficiency, the more serious is the impairment of the environment.

This leads to the conclusion by some that one way to improve the quality of the environment is to reduce the efficiency level of agricultural performance. If, for example, we use fewer chemicals in agricultural production we will contribute to an improvement in the environment.

But, let us review one area of interest. We have had as our objective and goal, in direct response to our needs, the increased production of food and fiber to alleviate shortages in our land. As a result we made our agricultural productivity the world's most efficient — for that matter the finest in the history of mankind.

Also, as a part of the quest for agricultural productive efficiency the food supply enjoyed by our citizens is the most economical with the highest quality of any period known to man. As a result food requires a smaller percent of the wage earner's take home pay than ever before in history.

Now, as we realize that there are some problems with waste products which come into being because of our improved efficiency, let us not panic into a regressive movement which will set back that progress we now enjoy. Instead, let us continue our research efforts with new, and additional objectives of preserving our environment — yes, expand our research to not only maintain our agricultural productive efficiency but to help in the correction of those factors which are not beneficial to our environment.

Harold E. Myers

Harold E. Myers, Dean
College of Agriculture, and
School of Home Econom

In this Issue . . .

Progressive Agriculture in Arizona

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Wheat Irrigation Affects Flour Yield & Quality

*by A. D. Day**

The wheat acreage in Arizona has been increasing significantly in recent years. Arizona wheat is grown for grain to be used for milling purposes, or livestock feed. This increased interest in wheat has stimulated questions on possible effects of irrigation on milling and baking qualities of wheat flour.

Effects of stressing wheat for water at different periods during growth on flour yield and quality were studied under field conditions for a two-year period (1966 and 1967) at Tucson, Arizona. Detailed materials and methods used in this experiment were reported in Progressive Agriculture in Arizona 21(5):8-10, 1969. At maturity, the grain was harvested and sent to the Western Wheat Quality Laboratory where 250-gram samples were used to obtain the following flour data: (a) yield, (b) protein (c) alkaline water retention capacity (A.W.R.C.), (d) viscosity, (e) mixing curve peak (60% absorption), and (f) mixing curve area. All data were analyzed using the standard analysis of variance and means were compared using Duncan's multiple range test.

**Agronomist, Arizona Agricultural Experiment Station, University of Arizona.* *Grateful acknowledgment is given to M. A. Barmore, former research chemist, Western Wheat Quality Laboratory, A.R.S., U.S. Department of Agriculture, Pullman, Washington, for his assistance with the flour quality evaluation.*

Flour Yield

Stressing wheat for soil-moisture at the jointing and dough stages of growth significantly reduced flour yields (Table 1). The greatest reduction in yield occurred when water was withheld at jointing, followed by moisture stress at the dough stage. Wheat with a high flour yield is worth more to a miller, because he sells flour for about twice what he receives for bran and shorts.

Flour Protein

Plants stressed for water at the flowering stage produced flour with the highest protein and its protein content was significantly higher than flour from wheat grown with optimum irrigation (Table 1). Withholding water from wheat at any stage of growth tended to increase flour protein. Since low protein is required in high quality pastry flour, stressing wheat for moisture lowers the value of its flour for this purpose. In addition, lower protein wheats are preferred for livestock feed, because cattle obtain less energy from protein than from carbohydrates.

Alkaline Water Retention Capacity

Witholding moisture during the jointing stage resulted in wheat flour with the highest alkaline water retention capacity, and moisure stress at flowering produced flour with the lowest A.W.R.C. (Table 1). Alkaline water retention capacity is a measure of pastry quality because there is a negative correlation between A.W. R.C. and cookie diameter.

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Table 1. Yield, protein, alkaline water retention capacity (A.W.R.C.), viscosity, mixing curve peak, and mixing curve area for flour from Maricopa wheat grown under four irrigation treatments at Tucson, Arizona in 1966 and 1967.

Irrigation treatment	*Flour yield (%)*	*Flour protein (%)*	*A.W.R.C. (%)*	*Viscosity (deg.)*	*Mixing curve peak (min.)*	*Mixing curve area (cm.²)*
Optimum irrigation throughout the growing season	**65.30 c+**	**9.95 a**	**60.03 ab**	**77.50 a**	**1.45 ab**	**72.13 a**
Plants stressed for water at the jointing stage	**62.25 a**	**11.98 ab**	**60.40 b**	**139.75 b**	**1.35 a**	**82.15 c**
Plants stressed for water at the flowering stage	**66.73 c**	**12.23 b**	**59.65 a**	**141.25 b**	**1.55 b**	**83.95 c**
Plants stressed for water at the dough stage	**63.78 b**	**10.88 ab**	**59.98 ab**	**89.50 a**	**1.80 c**	**77.70 b**
C. V. (%)	**1.21**	**3.60**	**0.49**	**12.40**	**5.08**	**2.51**

+Means followed by the same letter are not different at the 5% level of significance.

Price Differences Ranchers Receive for Steers and Heifers

*by C. Curtis Cable, Jr., Elmer L. Menzie, & Russell Gum**

Feeder steers and heifers are major sources of cash income for many Arizona ranchers. These two products are normally sold as either calves or yearlings. For most ranchers these two products are similar in that they are beef type animals and receive almost identical care up to the time they are sold. However, data on prices received by ranchers at Arizona auction markets in 1968, 1969 and the spring of 1970 reveal that a majority of steers sell from 4 to 6 cents a pound more than heifers. But, many ranchers sell both their steers and heifers through auctions, and are well pleased with the total dollar results of this method of marketing.**

Ranchers selling direct to country buyers report that differences in prices received for steers and heifers are 2 to 3 cents a pound. These cattlemen prefer this method of marketing because, according to them, they "get a fairer price for their heifers."

Almost all ranchers agree that steers perform better than heifers in the feedlot. Most ranchers also know that prices for slaughter steers exceed prices for slaughter heifers. However, how and to what degree these differences affect feeder steer and heifer prices and the profits from feeding cattle is a controversial subject among Arizona cattlemen.

The purpose of this article is to examine the effects of these and other differences and illustrate how they are reflected back to the rancher through prices paid for feeder steers and heifers. Major factors contributing to the differences in prices buyers are willing to pay ranchers for steers and heifers are: (1) prices buyers expect to receive for slaughter steers and heifers, (2) costs of feeding steers and heifers to slaughter grade and weight, (3) age and weight of feeder, that is, yearlings versus calves, (4) general price level for cattle, and (5) risks that heifers have been bred. Some relevant points to consider with regard to these price-making factors are summarized, and then their combined effects on feeder steer and heifer prices are illustrated with hypothetical examples.

Slaughter Cattle Prices

Almost all slaughter cattle fattened in Arizona are sold to packers in Arizona or California. The relationships between average weekly prices for Choice grade slaughter steers and heifers in Arizona and California, from January 1969 through July 1970, are shown in Figures 1 and 2. For Arizona, prices are for 900 to 1,100 pound steers and 700 to 900 pound heifers. For California, both steers and heifers weighed 900 to 1,100 pounds. Prices for slaughter steers were higher than for heifers the entire 82-week period in both states. The differences in weekly prices for Arizona ranged from a low of $0.70 to a high of $3 (Table 1). For California, the range

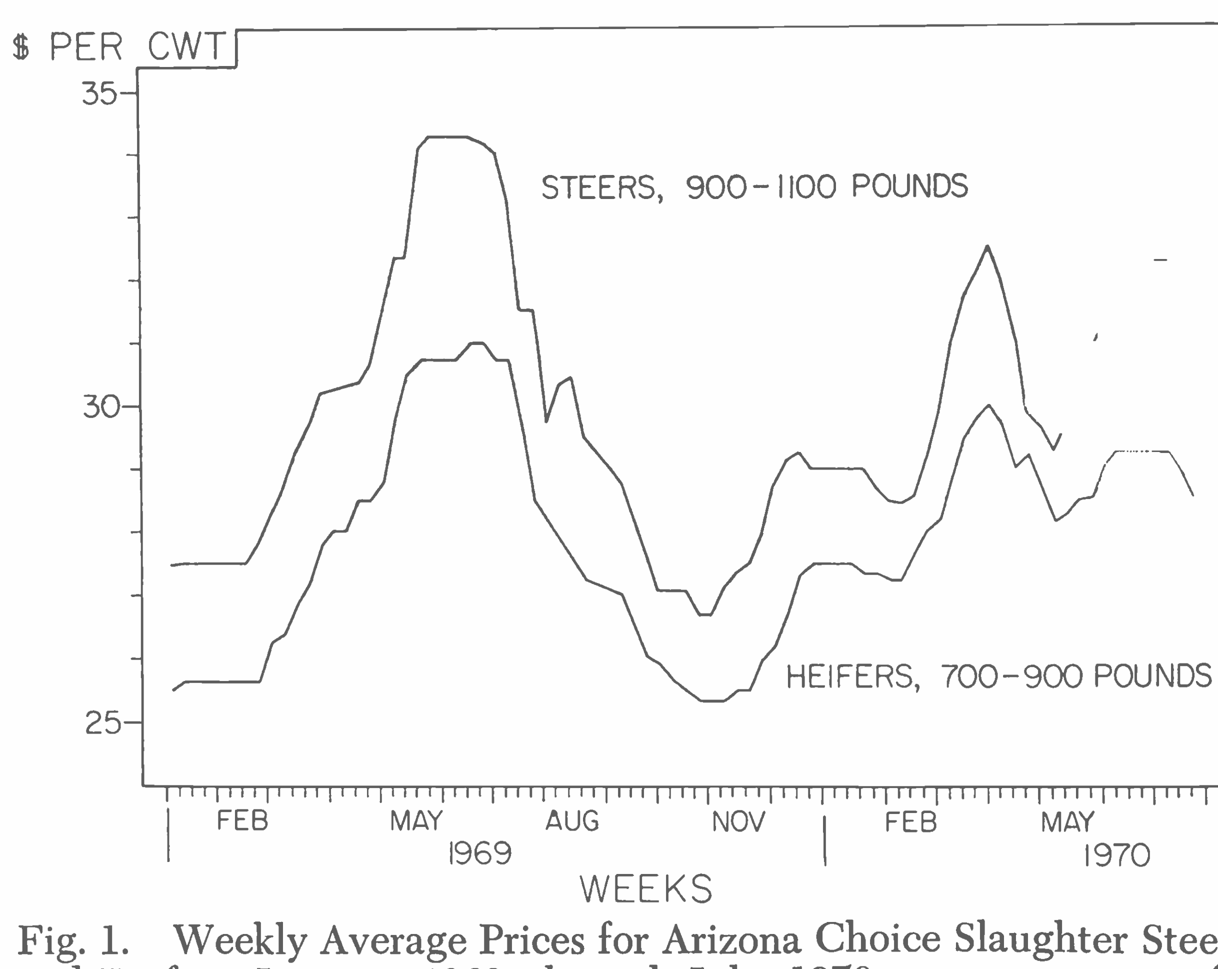

Fig. 1. Weekly Average Prices for Arizona Choice Slaughter Steers and Heifers, January, 1969, through July, 1970.

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***See "Gila Cattle Auction — A Smashing Success!" Progressive Agriculture in Arizona, Volume XX, No. 5, September - October, 1968, page 4.*

****The question is beyond the scope of this article. Factors affecting prices for slaughter steers and heifers will be the subject of an article in a subsequent issue of PA.*

was from $1.25 to $3.75. The difference was $2.00 or more for 44 weeks in Arizona and 56 weeks in California. It is to be expected that differences in prices for slaughter steers and heifers will be reflected in prices ranchers receive for feeder steers and heifers. Most ranchers agree with the logic of this conclusion, but question the justification for differences as great as 2 to 3 cents a pound in prices for slaughter steers and heifers.*** However, whether this price difference is or is not justified, the fact remains that cattle feeders must consider this difference when buying feeder steers and heifers.

Table 1. Comparison of Average Weekly Prices for Choice Slaughter Steers and Heifers, Arizona and California, January 1969 Through July 1970.

Steer Prices Greater than Heifer Prices by (Dollars/CWT.)	*Arizona*	*California*
	(Number of Weeks)	
Less than 1.25	7	0
1.25 to 1.74	17	10
1.75 to 2.24	22	36
2.25 to 2.74	22	25
2.75 to 3.24	8	7
3.25 or more	6	4
	82	82

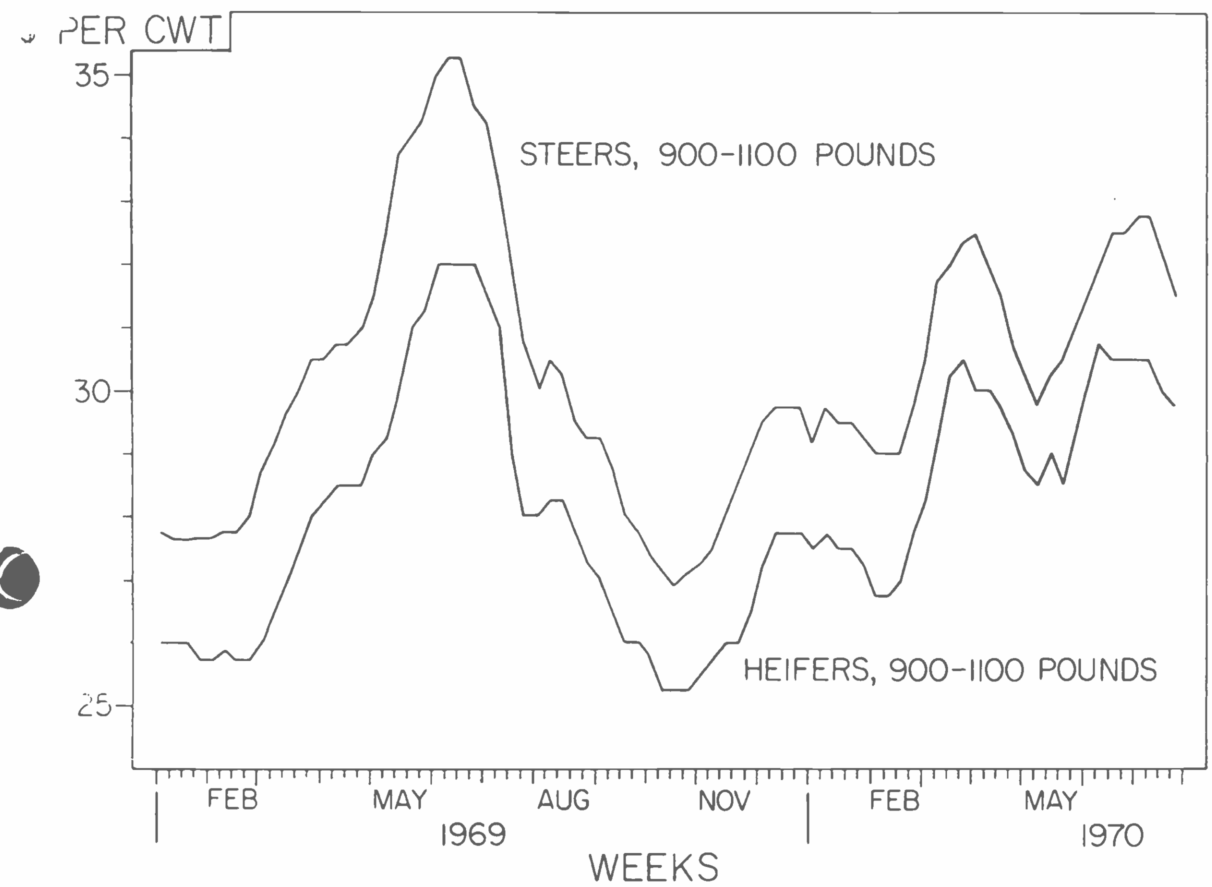

Figure 2. Weekly Average Prices for California Choice Slaughter Steers and Heifers, January, 1969, through July, 1970.

Costs of Gain for Custom Feeding

Grain and other ingredients in the ration plus processing and delivering feed to bunkers account for approximately 90 percent of the total cost of gain for custom feeding in Arizona. This percentage will vary slightly with differences in the cost of ration, custom feeding charge, and feed conversion ratio. The remaining 10 percent includes such variable items as interest on capital investment in cattle, death losses, and veterinary fees. These costs were combined and referred to as "all other costs" of gain in this article.

Major factors affecting the cost of ration are the proportion of concentrates used and the relative prices paid for different ingredients. Charges for custom feeding depend on the services provided by the feedlot. For this analysis, a charge of $10 per ton of feed delivered to bunkers was assumed for all animals. This charge combined with the cost of ration is referred to herein as custom feed cost.

The feed conversion ratio may range from less than 7 pounds to as much as 9 pounds of feed per 1 pound of gain. When only 7 pounds of feed are required per pound of gain, an increase in custom feed cost from $55 to $65 per ton will increase the feed cost per pound of gain by 3.50 cents (Table 2). However, if 8.2 pounds of feed are required per pound of gain, the same change in custom feed cost will result in a 4.10 cents increase in feed cost per pound of gain. If custom feed cost is $55 per ton, a change of 0.4 pound in feed conversion ratio results in a cost change of 1.10 cents per pound of gain. If custom feed is $65 per ton, the same change in feed conversion changes the cost per pound of gain by 1.30 cents.

Numerous factors affect the feed conversion ratio. Among these are breed, sex, weight, grade and condition of animal when put in the lot; ration or rations fed; climatic conditions; and competency of management. When all of these factors, except sex, are held constant, research and experiences of cattle feeders indicate that steers are more efficient

Table 2. Effects of Different Custom Feed Costs and Feed Conversion Ratios on Feed Costs per Pound of Gain.

Feed Conversion Ratio	*$55*	*Custom Feed Cost per Ton*[a] *$60*	*$65*
(Lb. Feed/Lb. of Gain)		*(Feed Cost/Lb. of Gain, Cents)*	
7.0	19.25	21.00	22.75
7.2	19.80	21.60	23.40
7.4	20.35	22.20	24.05
7.6	20.90	22.80	24.70
7.8	21.45	23.40	25.35
8.0	22.00	24.00	26.00
8.2	22.55	24.60	26.65

[a] *Equivalent costs per pound are 2.75¢, 3.00¢, and 3.25¢ respectively.*

feed converters than heifers. This difference in pounds of feed per pound of gain may range from 0.2 to 1.0 pounds. Cattle feeders must consider this difference in feeding efficiency in establishing prices they can pay for feeder steers and heifers.

Total Gain and Daily Rate of Gain

In the Southwest, many of the yearling steers and heifers weigh approximately 550 pounds when placed in the feedlot, and calves weigh about 400 pounds. Regardless of their initial weight, most of the steers reach a slaughter grade of Choice at a weight of approximately 1,050 pounds, and heifers at about 850 pounds. Because of differences in total pounds gained, heifers will be in the feedlot fewer days than steers of the same initial weight.

However, the difference in number of days on feed is dependent upon daily rate of gain as well as total gain. A typical average rate of gain during the fattening period for 550-pound steers is 2.8 pounds per day, and for 550-pound heifers 2.5 pounds per day. At these rates, it takes 179 days to add 500 pounds to yearling steers and 120 days to add 300 pounds to yearling heifers. Animals placed on feed at lighter weights can be expected to produce higher rates of gain. Assuming 400 pound steer calves gain an average of 3.0 pounds per day, it will take 217 days for them to reach a weight of 1,050 pounds. If 400 pound heifers gain an average of 2.7 pounds per day, they will weigh 850 pounds after 167 days of feeding.

Because of differences in total and daily rate of gain, estimates of returns to management necessarily differ between steers and heifers. This may be illustrated by assuming the cattle feeder wishes to realize a return for his management and on his investment of 10 cents per head for each day the animal is on feed, and treat this as a cost. Returns to management are, in effect, a self-paid salary, and therefore a true cost of being in the cattle feeding business.

On this basis, the cattle feeder must include $17.90 as a component of total cost of gain for a yearling steer, and $12.00 as an item of total cost of gain for a yearling heifer. In terms of cost per pound of gain, this is 3.58 cents for a yearling steer and 4.00 cents for a yearling heifer. This cost is 3.34 cents for a steer calf, and 3.71 cents for a heifer calf.

Combined Effects on Prices Received by Ranchers

Effects of differences due to sex on slaughter prices, rates of gain, total gain, and feed conversions along with the effects of differences between yearlings and calves and between relatively high and relatively low cattle prices are summarized in Table 3. The figures represent *typical differences* between feeder steers and heifers for specific combinations of factors, and illustrate a method of estimating the difference in the break-even prices that a cattle feeder can pay for feeder steers and feeder heifers (line q). They are not intended to be representative of average or typical prices, costs, or other data for any specific time.

Referring to Steer 1 and Heifer 1, a *difference* of 200 pounds in total gain (line b), $1 in slaughter prices (line d), and 0.1 pound in the conversion ratio (line f) were the major

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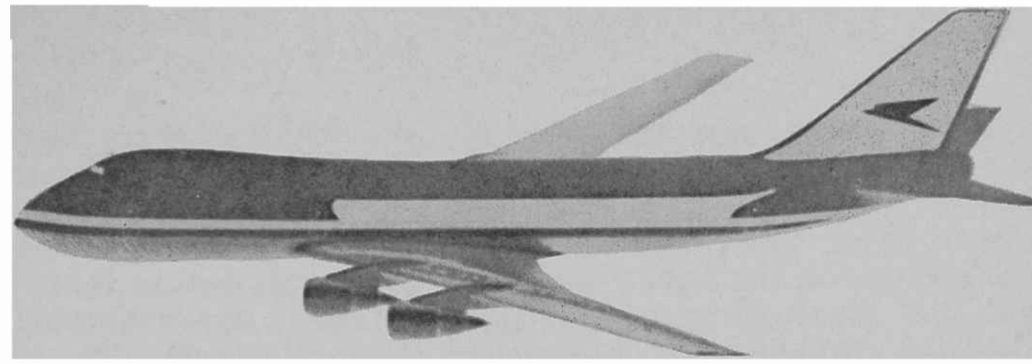
Table 3. Estimated Effects of Major Factors Affecting Price Differences Arizona Ranchers Receive for Steers and Heifers

Weight, Income and Cost Items[1]	*Yearling Feeders*						*Feeder Calves*		
	Relatively High Prices			*Relatively Low Prices*			*Relatively Low Prices*		
	Steer 1	*Heif. 1*	*Heif. 2*	*Steer 2*	*Heif. 3*	*Heif. 4*	*Steer 3*	*Heif. 5*	*Heif. 6*
a Purchase Weight, Pounds	550	550	550	550	550	550	400	400	400
b Total Gain, Pounds	500	300	300	500	300	300	650	450	450
c Selling Weight, Pounds (a + b)	1,050	850	850	1,050	850	850	1,050	850	850
d Selling Price, $/CWT.	32.00	31.00	29.50	28.00	27.00	25.50	28.00	27.00	25.50
e Gross Income, Dollars (c × d)	336.00	263.50	250.75	294.00	229.50	216.75	294.00	229.50	216.75
f Feed Conversion Ratio, Pounds	7.6	7.7	8.0	7.6	7.7	8.0	7.2	7.3	7.6
g Total Feed, Pounds (b × f)	3,800	2,310	2,400	3,800	2,310	2,400	4,550	3,195	3,330
h Cost of Custom Feed, ¢/Lb.[2]	3	3	3	3	3	3	3	3	3
i Custom Feed Cost/Lb. of Gain, Cents (f × h)	22.80	23.10	24.00	22.80	23.10	24.00	21.60	21.90	22.80
j "All Other" Cost/Lb. of Gain, Cents[3]	2.50	2.57	2.67	2.53	2.57	2.67	2.40	2.43	2.53
k Total Cost/Lb. of Gain, Cents (i + j)[4]	25.33	25.67	26.67	25.33	25.67	26.67	24.00	24.33	25.33
l Returns to Management/Lb. of Gain, Cents[5]	3.58	4.00	4.00	3.58	4.00	4.00	3.34	3.71	3.71
m Total Cost plus Returns/Lb. of Gain, Cents (k + l)[4]	28.91	29.67	30.67	28.91	29.67	30.67	27.34	28.04	29.04
n Total Cost of Gain and Returns to Management/Head, Dollars (b × m)[4]	144.55	89.01	92.01	144.55	89.01	92.01	177.71	126.18	130.68
o Amount Can Pay for Feeder to break-even, Dollars (e – n)	191.45	179.49	158.74	149.45	140.49	124.74	116.29	103.32	86.07
p Break-even Buying Price for Feeder, $/CWT. (o ÷ a)	34.81	31.73	28.86	27.17	25.54	22.68	29.07	25.83	21.51
q Break-even Buying Price for Steer Exceeds that for Heifer, $/CWT.		3.08	5.95		1.63	4.49		3.24	7.56

[1] *Data for lines, a,b,d,f,h,j, and l, are assumptions; see text for basis of assumptions.*
[2] *Includes cost of ingredients, mixing and delivering ration to bunkers.*
[3] *Non-feed cost to owner having cattle fattened in a custom lot; 10% of total cost of gain.*
[4] *Total cost excludes initial cost of animal.*
[5] *Based on 10 cents per head for each day animal is on feed.*

Air Shipment Prospects . . .



For Arizona Horticultural Crops

*by Robert S. Firch & Benjamin Hunter**

What are the prospects for air shipment of Arizona's horticultural products? This question has recently been asked by a number of leaders in Arizona's agricultural industry. The authors of this article have completed a study which attempts to answer that question.

Limited Air Shipment Experience

Arizona has had only limited experience with air shipment of horticultural crops. The only product that has been shipped by air in substantial quantities is cut flowers. The cut flowers are grown in the Salt River Valley in the winter and a high proportion of the crop is shipped in the baggage compartments of airliners going to eastern cities. Very small quantities of Arizona grown citrus, grapes, and tomatoes have been shipped by air, but these appear to be no more than experiments and have not been repeated.

Beyond Arizona's borders the authors have been able to find only three examples of air shipment of substantial quantities of horticultural products grown in the continental U.S. Again cut flowers are a prime example. This probably follows from the fact that the flowers are more perishable and have a higher value per unit of weight or volume than most fruit or vegetable commodities. In recent years, large quantities of California grown strawberries have been air-freighted to eastern markets. The air shipment of strawberries seems to be related to their extreme perishability and the deterioration of rail service, particularly by the eastern railroads. The total quantity of California strawberries shipped by air during the 1970 season showed a substantial decline from the year before.

The third major example of air shipment occurs as a jet freighter makes several round trips between Michigan and California each week. On the westbound flight it carries auto parts and on the return it carries California grown fruit and vegetables for a Detroit supermarket chain.

A review of these shipments and substantial air shipments in other parts of the world indicates that almost without exception the horticultural commodities are charged only back-haul rates. The back-haul rate is common in the trucking industry and arises because it is more profitable to make the return trip with the vehicle loaded with a commodity paying a very low tariff than returning it to the original origin empty. It is widely known that airlines carry more cargo on flights to the west than on flights to the east. For this reason the airlines have been willing to offer transcontinental rates for horticultural commodities which are about 60 percent less than the average charges for all commodities covering a wide range of shipment size and distance.

Lettuce Shipments to Eastern U. S. Markets

The study reported here concentrated on lettuce because it is among the most perishable of the horticultural crops and is produced in greater quantities in Arizona than any other horticultural commodity. Most of the information in the remainder of this article is based upon shipment of lettuce grown in the area of Salinas, California, because there has been a limited number of full planeloads of this lettuce shipped by air. New York City was chosen as the destination because this has been the destination of most of the shipments, and because the authors wanted to make the evaluation over a very long distance in order to give the air shipment the most favorable terms for comparison with rail or truck shipment. If air shipment from Salinas to New York is not more profitable than rail or truck shipments then it would be unlikely to be the preferred mode from Arizona to any point in the contiguous U. S.

Since there has been so little experience in air shipment of lettuce, it has been necessary to make many assumptions in the development of the information in the tables. These assumptions are based upon interviews with individuals considered to be most knowledgeable of this transportation problem. The transportation costs are based upon tariffs that were in effect in September of 1969.

The focus in the analysis is to determine the average costs per carton of salable lettuce in the New York City wholesale market when transported by various means. The elapsed time from field to the wholesale market is considered to be less than a day for air transport, 5 days by truck and 10 days for rail shipment. In recent years, most rail shipments have taken from 7 to 10 days, but for this analysis 10 days was selected in order to give the air shipment the most favorable terms for comparison. Because of the longer travel times for rail and truck shipments, larger proportions of these shipments can be expected to reach market in unsalable condition or to have substantially reduced shelf-

*Professor and Graduate Student, respectively, Department of Agricultural Economics.

life requiring sale at reduced prices. To allow for these losses in value while in transit it is assumed that in order to have 100 cartons of fully salable lettuce at the end of the shipment, it is necessary to ship 101 cartons by air, 105 cartons by truck, and 110 cartons by rail. This means that for truck and rail shipments the shipper must purchase and pay the shipping costs on a greater quantity of lettuce in order to have the same quantity of salable lettuce in the wholesale market. The procurement and transportation costs in Table 1 have been adjusted to reflect the fact that more than 100 cartons must be shipped in order to yield 100 cartons of fully salable lettuce in New York.

Another aspect of the time dimension is that for the slower modes of transport the shipper will have a greater quantity of lettuce in transit and thus more capital tied up in the ownership of lettuce. Therefore, the rail and truck shipments must bear a higher charge for the use of capital. It is assumed for this analysis that the appropriate rate of interest is 10 percent per annum on the procurement cost while the lettuce is in transit. The higher capital costs for rail and truck shipment are represented in Table 1 as costs of time.

Table 1 shows three different costs for air shipment. The current tariff for horticultural products shipped from San Francisco to New York City is about 5.5 cents per ton-mile (one ton carried one mile). There is considerable speculation that this rate will be lowered substantially when the new, larger planes come into service.

Table 1. Estimated Costs and Prices for Lettuce Shipped from Salinas, California, to New York City by Various Means of Transport.

			Air at Various Rates /Ton Mile		
	Rail	*Truck*	*4¢*	*5.5¢*	*8¢*
$1.25/Carton FOB Price					
Costs:			*$/Carton*		
Procurement	1.38	1.31	1.26	1.26	1.26
Transport	1.25	1.58	3.40	4.44	6.13
Time	.00[a]	.00[a]	.00[a]	.00[a]	.00[a]
Total in wholesale market	2.63	2.89	4.66	5.70	7.39
Wholesale Price	2.97	3.27	5.27	6.44	8.35
Retail Price	4.16	4.58	7.38	9.02	11.69
$2.50/Carton FOB Price					
Costs:					
Procurement	2.75	2.62	2.52	2.52	2.52
Transport	1.25	1.58	3.40	4.44	6.13
Time	.01	.00[a]	.00[a]	.00[a]	.00[a]
Total in wholesale market	4.01	4.20	5.92	6.96	8.65
Wholesale Price	4.53	4.75	6.69	7.86	9.77
Retail Price	6.34	6.65	9.37	11.00	13.68
$5.00/Carton FOB Price					
Costs:					
Procurement	5.50	5.25	5.05	5.05	5.05
Transport	1.25	1.58	3.40	4.44	6.13
Time	.02	.01	.00[a]	.00[a]	.00[a]
Total in wholesale market	6.77	6.84	8.45	9.49	11.18
Wholesale Price	8.53	8.62	10.65	11.96	14.09
Retail Price	11.94	12.07	14.91	16.74	19.73

[a] *Less than one-half cent per carton.*

The Boeing company has designed a cargo version of its 747 airliner which will have a maximum payload of about 260,000 pounds, and Lockheed has designed a civilian version of its C-5A military plane that will have a gross payload of 300,000 pounds. At the time of this writing neither company has any orders for these civilian cargo planes. It will probably be late in this decade before any substantial number of these planes will be in service. The air carriers are currently suffering under a problem of excess capacity on both passenger and cargo aircraft, and the problem will probably continue for several years as the air-lift to Vietnam is scaled down and the new wide-bodied passenger planes displace 707 and DC-8 class aircraft from passenger service. The cargo fleet that is currently operating is composed almost entirely of 707 and DC-8 class planes.

The Civil Aeronautics Board (CAB) gathers large quantities of statistics on cost, revenues and performance for U. S. aircraft. These figures reveal that in recent years the all-cargo planes on domestic flights have operated at only a 45 to 55 percent load factor. This means that on the average the planes have been carrying only about one-half of their weight carrying capacity. This is partly explained by low density cargo that fills the volume of the plane before its weight-lifting capacity is reached.

The CAB figures indicate that the average cost was about 20 cents per ton-mile of service actually performed. The CAB also computes what it calls operating expense per available ton-mile. This simply divides the actual expenses that were incurred by the weight carrying capacity of the flights that were actually flown. Since the load factor has been about 50 percent, the computed expense per available ton-mile is about 10 cents. At best, the cost per available ton-mile can be considered no more than a lower limit estimate of potential costs for the mix of sizes and length of individual customer shipments that have been carried in the past. As the planes are operated at nearer their weight carrying capacity the total operating expense would surely increase.

Total operating expense as the CAB has defined these terms is composed of about ⅔ direct operating cost and ⅓ indirect operating cost. The manufacturers estimate that the potential direct operating costs per available ton-mile of the new aircraft will be 25 to 30 percent less than the jets that are currently operating. The 4 cent per ton-mile rate for air shipment in Table 1 reflects what the rate for horticultural products might be if it were reduced by the same proportion as the direct operating costs of the new aircraft.

If large quantities of horticultural products began to move by air in the future, this would reduce the imbalance of eastbound and westbound cargo movement and reduce the airlines incentives to offer back-haul rates for these products. The 8 cent per ton-mile rate in Table 1 represents what the full operating cost of the new aircraft might be when these planes are well established in civilian cargo operations. The authors of this report believe that the 8 cent per ton-mile rate is more likely than the 4 cent rate.

As the industries are currently organized, trucks and rail cars are typically loaded near the lettuce fields and move essentially directly to the wholesale market in the eastern city. For air shipment the commodity must be moved from the lettuce fields to the airport, loaded aboard a plane, unloaded from the plane in the destination city and hauled to the wholesale market. To allow for this ground transportation and handling, not included in the air tariff, a charge of $1.50 per carton has been included in the air transport charge in Table 1.

A study of lettuce price relationships reveals that on average the wholesale price in New York City exceeds the total cost of procurement and rail transportation by about 13 percent when the FOB price of lettuce is in the range of $1.25 to $2.50 per carton. This wholesale markup goes up to an average of 26 percent when the FOB price is $5.00 per carton. The typical retail markup for vegetable commodities is 40 percent. These price relationships have been used to estimate the expected wholesale and retail prices for the combinations of FOB price and transportation specified in Table 1.

Most of the western grown lettuce is packed in cartons containing 24 heads each. In Table 2, the retail prices per carton of Table 1 have been divided by 24 to give estimates of the prices that the housewife might find in New York City supermarkets for the various combinations of FOB price and transportation. When the FOB price is $1.25 per carton the retail price per head ranges from 17 cents for rail to 49 cents per head for air shipped lettuce when the rate is 8 cents per ton-mile. This range is from 50 to 82 cents per head when the FOB price is $5.00 per carton.

Table 3 shows the percentage by which the prices of truck and air shipped lettuce would be expected to exceed the retail price of rail shipped lettuce for the different levels of FOB price. Table 2 shows a slight tendency for the differential cents per head to decline as the FOB price increases. Table 3 shows a substantial decline in the differential percentage as the FOB price increases. The differential cents per head or percentage over rail shipped lettuce of course increases as the air transport cost per ton-mile increases for each FOB price.

Of the Arizona grown lettuce that was shipped to New York City during 1969, 1,639 carlot equivalents traveled by rail and only 99 equivalents left Arizona by truck. Under current market and product conditions the market generally does not seem willing to pay the relatively small premium required to cover the differential costs between rail and truck shipment. This occurs even though truck shipment reduces transit time by as much as one-half and should create some quality differential. The tables indicate that the necessary premium for truck shipments declines as the FOB price increases. A substantial part of the truck shipments may in fact have occurred when the FOB price was high and required very small premium or no premium for higher quality. The fact that the markets generally have not been willing to pay the small additional cost for truck shipment raises considerable doubt as to whether a commodity such as lettuce will move by air in the foreseeable future.

Table 2. Estimated New York City Retail Prices for Western Lettuce Shipped by Various Means of Transport.

	Rail	Truck	Air at Various Rates /Ton Mile 4¢	5.5¢	8¢
	Cents/Head				
$1.25/Carton FOB Price					
Retail Price	17	19	31	38	49
Premium over rail	—	2	14	21	32
$2.50/Carton FOB Price					
Retail Price	26	28	39	46	57
Premium over rail	—	2	13	20	31
$5.00/Carton FOB Price					
Retail Price	50	50	62	70	82
Premium over rail	—	0	12	20	32

In recent years some lettuce has been shipped under controlled atmosphere conditions. This process involves introducing carbon dioxide and other gases into the loaded truck van or rail car to displace the oxygen that is normally present. This reduces the rate of respiration and deterioration of the lettuce. Most of the lettuce that is shipped in controlled atmosphere has been purchased by an eastern buyer willing to pay the additional costs. But, the fact that controlled atmosphere shipment has not become a common practice and only small quantities are shipped by truck suggest that the lettuce that is currently being grown does not show economically significant quality deterioration

Table 3. Estimated Percent by Which Retail Price of Truck and Air Shipped Lettuce Would Exceed the Retail Price of Rail Shipped Lettuce in New York City.

FOB Price dollars/carton	*Truck*	*Air at Various Rates/Ton-Mile* 4¢	5.5¢	8¢
	percent			
1.25	12	82	124	188
2.50	8	50	77	119
5.00	0	24	40	64

(Continued on Page 15)

Onion Seed Production in Yuma County

*by Don R. Howell & G. D. Waller**

Introduction.

The 2,000 acres of onions (*Allium cepa L.*) grown for seed annually in the U. S. produces an average of slightly less than 500 pounds of seed per acre. Much of it is hybrid seed from male-sterile plants in adjacent rows or in rows that are several rows away. Seed for southern types — the so-called "short-day" onions, is grown in southern California and southwestern Arizona. Seed for northern types, or "long-day" onions, is grown primarily in Idaho, Oregon, Washington and Northern California. This seed is used throughout the United States to plant 100,000 acres of bulb, or green onions, with a farm value of $100 million (USDA, 1969).

Onion seed production is generally most successful in an area which has warm sunny days during the period of bloom followed by a squall-free period during which the seed can mature without excessive shattering. Yuma County, Arizona enjoys such climate. Farmers in Yuma County are interested in producing onion seed. But, because yields have proven to be so inconsistent, onion seed production is considered a high-risk crop. By example, various growers report the 1969 yield varied from 45 to 1550 pounds of clean seed per acre.

During 1969 and 1970 commercial onion seed fields were visited in Yuma County to determine why some growers have seed crop failures.

Planting.

The planting method for onion seed production varies depending on whether open pollinated, or hybrid, seed is to be produced. It varies also as to whether it was planted by seed or bulbs.

Onion seeds are planted on 42 inch beds in two rows, twelve inches apart on each bed. The bulbs are planted in one row on the center of each bed. Open pollinated varieties are grown from either seed or bulbs. Hybrid seed is usually obtained from male-sterile plants grown from seed and crossed with male-fertile plants grown from bulbs. The ratios of male-sterile to male-fertile rows maybe four to one, eight to two, or twelve to two.

Figure 1. Harvesting onion seed with a modified combine, note the male-fertile rows on the right that have been pressed down to prevent mixing them with the male-sterile rows being harvested for hybrid seed.

The seed is planted in September, but bulbs are not planted until November. Planting rate for seed is five or six pounds per acre; while planting rate for bulbs depends on the size of the bulbs used. Planet Junior type planters were used for planting seed, while bulbs were dropped mechanically and then set into an upright position by hand before covering.

Fertilization.

Growers contacted reported that they applied preplant fertilizers at the rate of 60 pounds of nitrogen and 180 pounds of phosphate per acre. Post plant applications averaged 170 pounds of nitrogen and 115 pounds of phosphate per acre. Both sidedressing and water run fertilizers were used in the post plant applications.

Irrigation.

Irrigation practices were similar for most growers. Fields were usually pre-irrigated, but some fields were "irrigated-up" particularly when the seeds were planted.

Irrigations in September and October were at about two week intervals, but as weather cooled this interval lengthened. The biggest difference in irrigation practices was between seed-to-seed and bulb-to-seed crops.

Seed-to-seed fields must be "shocked" during the winter so the plants will bolt (produce seed heads). Irrigations are withheld during the winter to produce the shock effect. This shock period will usually last about two months, beginning about December first.

When bulbs are used for planting stock they need not go through a shock period, and are therefore irrigated during the December and January months. This time coincides with the coolest temperatures of the year, so frequent irrigations are unnecessary. A three week irrigation interval is common during the spring

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***Trade names used in this publication are for identification only and do not imply endorsement of the products named or criticism of similar products not mentioned.*

Figure 2. Rear view of combine elevating onion seed stalks into the wagon that is pulled along beside the combine.

when the growing rate increases. As bolting becomes pronounced and a few blooms start to open, irrigation intervals are shortened to two weeks. This interval is maintained until the "dry-up" for harvest.

Control of Pests.

Herbicides were used by all growers contacted. Two applications of DCPA (Dacthal**) were applied to most fields. One application was commonly incorporated in a preplant treatment and the other was applied post plant at layby, or as needed. Application rates varied from eight to twelve pounds per acre.

Other herbicides were tried on an experimental basis. Weeds were thought to be a serious problem since the crop is actually in the ground for a long period of time (September to July, eleven months), and both summer and winter weeds need to be controlled. Mechanical cultivators and hand labor were used for additional weed control. Hand labor was also used for rogueing, or the removal of off-type plants.

Downy mildew (*Peronospora destructor*) infected some fields of onions seriously in 1969, but in 1970 it infected nearly every field. It was the main cause of seed crop failure in some fields and reduced yields drastically in others. Some fungicidal treatments were attempted, but most growers felt that mildew control was impractical, if not impossible to control when conditions for the disease development were ideal, as they were during the cool damp winter of 1970. Purple blotch (*Alternaria porri*) infected many fields in 1970 and caused severe injury in at least one field.

Insect pests discussed by growers were onion thrips (*Thrips tabaci*), flower thrips (*Franklindella tritici*), and armyworms (*Laphygma* spp.). Thrips were the most troublesome insect and treatment for them was thought by most growers to be critical since flower thrips caused damage mainly when the crop is in bloom and bees are necessary for pollination. For this reason some growers did not use any insecticides while others treated only before the onset of bloom. Phosdrin** and the parathion** were both reported as fairly successful in controlling thrips during 1969.

Armyworms were troublesome only when the onions were planted from seed and then only while the onion plants were quite small. One grower did treat to control armyworms.

Pollinators.

Many insects visit onion flowers, but the honey bee (*Apis mellifera L.*) is the most valuable of the pollinators (Shaw and Bourne, 1936). Few non-honey bee pollinators were observed visting onion seed fields. Most growers rent four or more honey bee colonies per acre for pollination purposes and generally distributed them around the field in groups of 6 to 12 colonies after flowering has commenced. Additional colonies are added if bee activity on the onion flowers is considered inadequate. Onion seed fields are usually isolated from each other to prevent contamination by undesirable sources of pollen. The relatively small fields are often surrounded by large fields of other crops or by areas

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Figure 3. Dumping onion seed stalks onto polyethylene tarps to dry them in preparation for threshing.

Grain Sorghum . . .

A Source of Insect Predators for Insects on Cotton

by R. E. Fye[*]

Arizona cotton growers are becoming increasingly aware of the need to reduce production costs. A potential way for reducing costs is by interplanting cotton and other crops on the farm to make the best use possible of naturally occurring predators of cotton pests.

Grain sorghum planted with cotton offers one potential beneficial crop association. Aphids feeding on the grain sorghum provide food for a large array of predators of injurious cotton insects and the large predator populations in the sorghum overflow into the cotton. The aphids on the sorghum do not attack the cotton, lygus bug populations on sorghum are negligible and with the exception of the bollworm, which generally causes little damage to cotton in the early growing season, the insects associated with sorghum do not present a hazard to cotton. Therefore interplanting of

Table 1. Insect predator populations in selected fields of cotton and grain sorghum. Avra Valley, Arizona 1970.

Predator	*No. per acre (thousands) during the weekending:* May 29[1]	June 5	June 12	June 19	June 26	July 3	July 10	July 17[2]	July 24[2]	July 31[2]	Aug. 7[2]
						Cotton					
Lacewing eggs		**2.2**	**3.6**	**4.9**	**12.5**	**12.0**	**23.0**	**3.6**	**3.6**	**18.8**	**12.0**
Lacewing adults		**0.6**	**0.1**	**0.2**	**0.2**	**0.2**	**2.7**	**1.0**	**0.8**	**2.8**	**2.8**
Active Predators:											
Collops beetle adults		**0.3**	**1.1**	**1.0**	**3.9**	**10.6**	**11.5**	**1.8**	**0.3**	**0.5**	**0.9**
Ladybird beetle larvae and adults			**0.5**		**0.1**	**1.8**	**10.5**	**16.0**	**3.6**	**1.0**	**2.3**
Big-eyed bug nymphs and adults	**0.3**		**2.6**	**6.7**	**10.8**	**11.9**	**19.5**	**0.3**		**0.3**	
Spiders		**3.0**	**1.0**	**1.7**	**1.9**	**2.5**	**2.2**	**1.3**	**0.5**	**0.3**	**0.1**
Other[3]		**0.3**	**8.7**	**9.8**	**12.5**	**4.4**	**3.6**	**0.5**	**0.5**	**1.3**	**1.4**
Total active predators	**0.3**	**3.3**	**13.9**	**19.2**	**29.2**	**31.2**	**47.3**	**19.9**	**4.9**	**3.4**	**4.7**
						Grain sorghum					
Lacewing eggs	**18.1**	**74.8**	**207.2**	**34.9**	**326.6**	**267.1**	**95.9**	**102.3**	**10.3**	**76.2**	**55.6**
Lacewing adults	**30.7**	**38.7**	**24.9**	**19.7**	**53.6**	**44.8**	**28.0**	**41.3**	**7.9**	**9.8**	**7.4**
Active Predators:											
Collops beetle adults		**7.2**	**4.6**	**19.2**	**21.1**	**11.3**	**17.2**	**11.3**	**2.5**	**5.9**	**8.8**
Ladybird beetle larvae and adults	**63.7**	**74.8**	**103.0**	**56.6**	**86.1**	**1463.9**	**514.0**	**306.5**	**145.6**	**62.0**	**43.3**
Big-eyed bug nymphs and adults			**0.7**	**2.9**	**6.4**	**12.8**	**3.4**	**3.9**	**4.4**	**3.4**	**1.5**
Spiders				**3.4**	**1.0**	**3.4**	**12.8**	**18.2**	**22.1**	**25.6**	**19.7**
Other[3]	**1.5**	**3.3**	**1.4**	**5.5**	**8.4**	**11.8**	**2.0**	**4.0**	**1.0**	**1.0**	**0.5**
Total active predators	**65.2**	**85.3**	**109.7**	**87.6**	**123.0**	**1503.2**	**549.4**	**343.9**	**175.6**	**97.9**	**73.8**

[1] *Grain sorghum sprayed with dimethoate 0.3 lb/acre on April 23.*
[2] *Cotton sprayed with 4 lb. toxaphene + 1 lb. methyl parathion/acre on July 15, 21, 27 and August 3*
[3] *Nabids, reduviids, minute pirate bugs (Orius spp.) and lacewing larvae.*

Figure 1. An interplanting of cotton with grain sorghum. Is this in the future for cotton production in Arizona? asks the author.

cotton and sorghum should be highly beneficial.

A study was made in 1970 in the Avra Valley to determine the extent of the interchange of predators between adjacent grain sorghum and cotton fields.

A 100 acre field of grain sorghum planted in early spring became heavily infested with aphids. First, the corn leaf aphid, *Rhopalosiphum maidis* (Fitch), infested the whorls of the grain sorghum and dimethoate was applied for its control on April 23. However, the infestation persisted and later in the season was replaced by an extremely heavy infestation of a biotype of the greenbug, *Schizaphis graminum* (Rondani), which has occurred in increasing populations in grain sorghum in Arizona in the past 4-5 years. Concurrently, large numbers of predators developed on the greenbugs in the grain sorghum. The data in table 1 show the populations of predators in the grain sorghum from late May until harvest on August 7. At all times during the growing period of the grain sorghum the potential for a large lacewing (*Chrysopa* spp.) population was present in the field as indicated by the counts of eggs and adults. The impact of the lacewing population was difficult to assess because the larvae remain well hidden are difficult to count. Throughout the growing season the active predator population ranged from almost 1 to 15 predators per plant with the stand averaging 98,000 plants per acre. In early July the active predator population, consisting primarily of ladybird beetle adults and larvae, exceeded 1 to 1.5 million predators per acre. Large populations of *Collops* beetles and big-eyed bugs, *Geocoris* spp., also were in the field through most of the season. As the season progressed the populations of spiders in the grain sorghum increased and levelled off at about 1 spider for every 4 plants.

Migration of the mobile forms of the predators from the grain sorghum is evident in the population data taken on the far side (0.25 miles distant) of an adjacent cotton field. Relatively large populations of active predators (0.5-1.5 per plant) occurred from mid June until mid July when applications of insecticides became necessary to control the pink bollworm, *Pectinophora gossypiella* (Saunders). Large populations of *Collops* beetles, ladybird beetles, *Hippodamia* spp., big-eyed bugs and other predators were in the field until that time. Lacewing eggs and adults also occurred in large numbers reflecting a strong potential for populations of lacewing larvae which are active predators of bollworm, *Heliothis zea* (Boddie), eggs. Because available food in the cotton was limited, populations of the mobile predators were migratory but probably had some suppressive effect on pest populations as they sought food during their migration.

Although the full food range and the impact of the predators is not fully understood it is known that the predators attack many insects injurious to cotton. Therefore, the grower should be aware of the beneficial insect populations in his cotton fields.

The preliminary data suggest that interplantings of cotton and grain sorghum in large blocks within fields might greatly facilitate the interchange of predators from grain sorghum to cotton. The data in table 1 also indicate that the grain sorghum might provide a ready reservoir of predators for migration into the cotton during the time insecticides are applied replenishing to some extent the populations decimated by them. Therefore large numbers of predators can probably be produced in aphid-infested grain sorghum that might readily transfer to cotton as the sorghum matures. Since only extremely high infestations of the greenbug cause an economic reduction in the yield of grain sorghum, it is apparent that the grower growing sorghum and cotton concurrently in adjacent fields would benefit greatly through the interplanting of the two crops.

The author expresses his sincere appreciation to Mr. W. W. Jarvis for his kind cooperation during the study.

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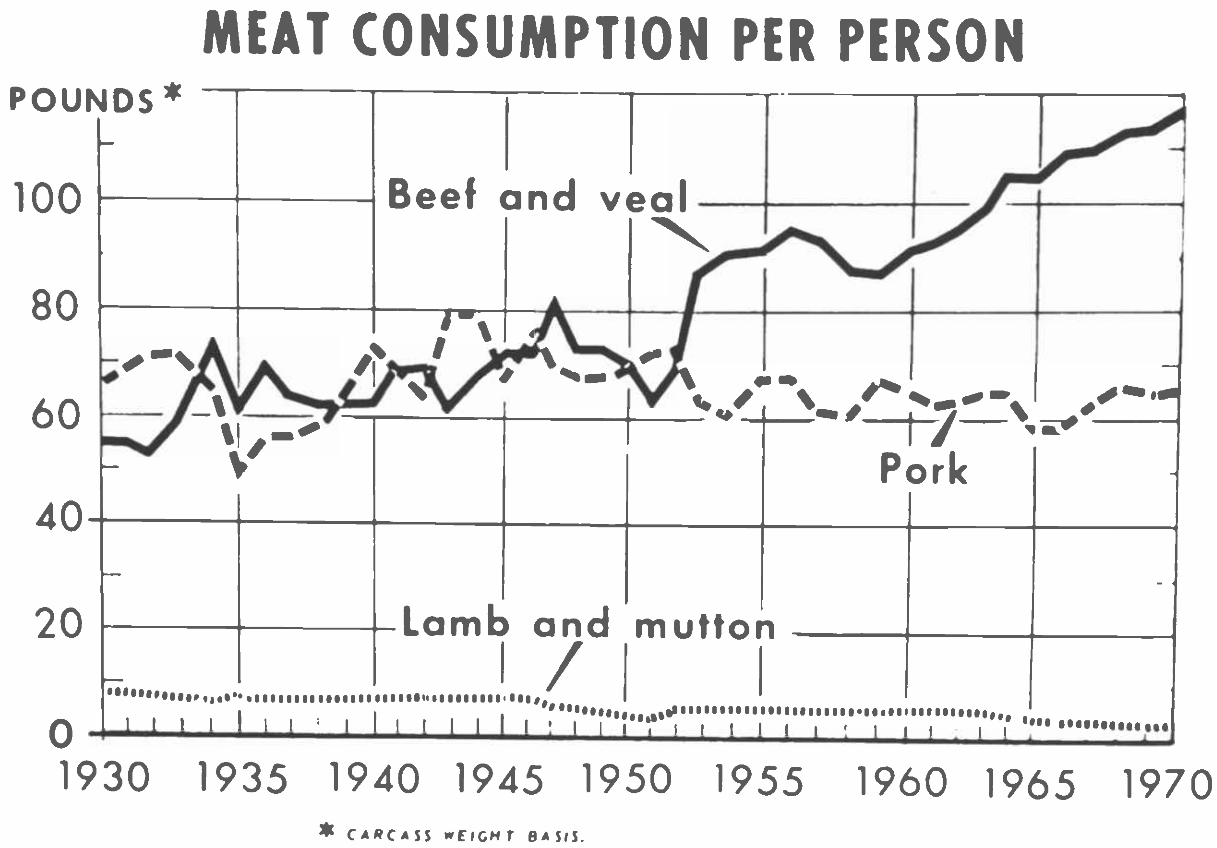

Beef Supply for 1970 . . . will Cattlemen Meet Demand?

*by C. Curtis Cable, Jr.**

U.S. consumers like beef. We ate approximately 23.4 billion pounds of it in 1970. This is an increase of 55 percent from the 15.1 billion pounds consumed in 1960.

What accounts for this big increase in beef consumption?

Population growth of 26 million people during this 10-year period is part of the answer. In addition, incomes increased dramatically. As a result, per capita consumption of beef increased by 29 pounds — from 85 pounds in 1960 to 114 pounds in 1970.

Per capita consumption of other red meats remained fairly constant during the 1960s (see chart). However, per capita consumption of chicken increased from 28 to 42 pounds during the 1960-1970 period. Obviously meat is becoming more and more popular as a food, and beef is leading the way.

U.S. cattlemen produced 21.7 billion pounds of beef in 1970 (imports made up the difference). This U.S. production is 48 percent more than the 14.7 billion pounds produced in 1960.

But, the number of cows in the nation's 1970 cow herd was up only 12 percent from 1960.

Why was the increase in beef production so much greater percentagewise than the increase in cow numbers?

In addition to the nominal increase in cow numbers, our increased beef production during the 1960s has been possible:

. . . because of a decline in calf slaughter from 8.6 million head in 1960 to 4.4 million head in 1970 — most of these animals are now fed to heavier weights;

. . . because of a switch from grass fattening to grain finishing before slaughtering — less than 2 million grass fat steers and heifers were slaughtered in 1970, down from 5 million head in 1966;

. . . because about 25 million head of grain-fed cattle were marketed in 1970, about double the number for 1960;

. . . because of an increase in calf crop per 100 cows — from 86 in 1960 to 90 in 1970;

. . . because weight gains have been more rapid allowing cattle to move to slaughter at a younger age.

In addition, the shift from dairy cows to beef cows has contributed to increased beef production. Dairy cow numbers are still declining, but at a slower rate. Also, some increase in feeding dairy calves has occurred.

Decreases will likely continue in the number of calves slaughtered, as well as in the number of grass fat animals slaughtered. Instead, more and more of these animals will be finished to heavier weights in feedlots.

As these decreases occur, they will give some help in beef production. But, when no further decreases in these two items take place, additional increases will have to come from other sources.

Cattlemen responded to the expanding market for beef in the 1950s and 1960s. This is indicated by the earlier figures on beef production.

But, by 1980 the U. S. population will be about 230 million. And, reliable sources predict that per capita consumption of beef will be at least 130 pounds. Thus, the U.S. will need about 30 billion pounds of beef. Can U.S. cattlemen produce this much?

To do so, they must put more emphasis on

. . . increasing the cow herd;

. . . increasing the percentage calf crop; or

. . . finishing grain-fed animals to heavier weights.

On the basis of increases in breeding herds which are taking place, it would appear that cattlemen have accepted the challenge.

Marketing Specialist, Cooperative Extension Service, U of A.

Prices for Steers & Heifers

(from Page 6)

factors contributing to the $3.08 per hundredweight difference in the break-even buying prices between steers and heifers (line q). The difference in break-even buying prices increases to almost $6 per hundredweight if the difference in slaughter prices is $2.50 and the difference in feed conversion is 0.4 pounds (Heifer 2).

Differences in break-even buying prices between yearling feeder steers and heifers tend to be less when cattle prices are relatively low. For example, the difference between Heifer 3 and Steer 2 is less than the difference between Heifer 1 and Steer 1, primarily because the general level of slaughter cattle prices was $4 per hundredweight lower.

Differences in weight of animals when placed on feed is also an important factor affecting differences in feeder prices between steers and heifers. This is evident from a comparison of the differences between Heifer 5 and Steer 3 and between Heifer 3 and Steer 2.

The examples indicate that there is justification for differences in prices paid ranchers for steers and heifers. The amount of the difference depends on differences in slaughter prices, conversion ratios, total gain, rate of gain, price levels, initial weight of feeders, and risks associated with possibility that heifers are pregnant.

Although differences in prices per hundredweight received for steers and heifers is important, it is more important for individual ranchers to consider *total dollars received* for their cattle and the *total cost* of production and marketing. The difference between these two totals represents the net returns to their business.

If in doubt as to the most profitable method of marketing, a rancher selling to country buyers should compare his total dollars received from steers and heifers with an estimate of what could have been received if he had sold through an auction. Likewise, a rancher who sells through an auction should compare his total dollars with an estimate of what he could have obtained if he had sold by some other method.

Air Shipment Prospects.

(from Page 9)

during the normal 7 to 10 day rail shipment. If quality deterioration was important it could be reduced by controlled atmosphere shipment at substantially lower cost than by air shipment.

What set of circumstances might make domestic air shipment of lettuce or similar commodities economically worthwhile? It is doubtful that any conceivable reduction in air tariffs alone will be sufficient to bring about air shipment. There is a possibility that a large scale identification and promotion program could convince the housewife that the air shipped product is worth the extra cost. A new variety of lettuce might be produced that has greater consumer appeal but is too perishable to be shipped by truck or rail. This would facilitate the promotion approach. Air shipment might be possible by shredding the lettuce before shipment to allow enough saving in weight by shipping only the portion of the lettuce head that is actually consumed while making a much more perishable product.

Lettuce Shipments to European Markets

What are the prospects for overseas air shipment of horticultural products? Table 4 presents an evaluation of the relative costs of lettuce shipped to northern European port cities by air and surface means. The surface transport involves rail shipment to New York City and then overseas shipment on a containership. The lettuce going to the European market is typically of smaller heads and packed in lighter weight cartons than lettuce for the domestic market. The analysis assumes a weight of 32 pounds per carton. The air tariff that is currently available over this route is about 7.2 cents per ton-mile.

It appears likely that when the FOB price of lettuce was $1.25 per carton the European retail price of air shipped lettuce would be more than double the price of the lettuce shipped by surface means. When the FOB price is $5.00 per carton the premium for air shipped lettuce would have to be a little more than 50 percent of the price of the surface shipped product. The great difference in transit time, one day rather than 18 days, substantially improves the prospect that the market would recognize enough quality differential to be willing to pay the necessary price premium to allow air shipment to succeed. Again, air transport would become more attractive with promotion programs and changes in the form of the product.

Table 4. Estimated Costs for Lettuce Shipped From California to Northern European Port Cities by Air and Surface Methods.

	Surface	*Air*
	$/Carton	
$1.25/Carton FOB Price		
Procurement	1.38	1.26
Transport	3.41	8.99
Time	.01	.00[a]
Total	4.80	10.25
$2.50/Carton FOB Price		
Procurement	2.75	2.52
Transport	3.41	8.99
Time	.01	.00[a]
Total	6.17	11.51
$5.00/Carton FOB Price		
Procurement	5.50	5.05
Transport	3.41	8.99
Time	.02	.00[a]
Total	8.93	14.04

[a] *Less than one-half cent per carton.*

Wheat . . .

(*From Page 3*)

Viscosity

Stressing wheat for soil-moisture at the jointing and flowering stages resulted in flour viscosity ratings that were significantly higher than flour viscosities from wheat stressed at the dough stage or grown with optimum irrigation (Table 1). These data indicate that when soil-moisture was withheld from wheat it resulted in flour with higher viscosity and stronger gluten. Wheat with these characteristics and that which is produced in this manner is less desirable for milling.

Mixing Curve Peak

In evaluating wheat flour, the length of time required to reach the mixing curve peak and the total area under the mixing curve are measures of flour quality. Normally, anything that increases the mixing curve peak or area tends to lower the quality of wheat for milling purposes.

When wheat was stressed for water at the dough stage, it required a longer time to reach the flour mixing curve peak than when wheat was grown under any other treatment (Table 1). The shortest time required to reach the flour mixing curve peak was obtained when water was withheld from wheat at jointing, and the longest time was obtained when moisture stress occurred at the dough stage.

Mixing Curve Area

Stressing wheat for moisture at any stage of growth significantly increased the flour mixing curve area (Table 1). The lowest flour mixing curve area was obtained when wheat was grown with optimum irrigation, followed by moisture stress at the dough, jointing, and flowering stages, in increasing order. The flour mixing curve data also suggest that when wheat was grown under soil-moisture stress, it resulted in stronger gluten flour, which would have to be blended differently by the miller or baker.

Increases in viscosities and mixing curve areas of flour from grain from stressed plants were due to the increases in flour protein content. However, changes in A.W.R.C. and mixing curve peak values were not related to changes in protein content and must be due to other factors resulting from water stress.

Onion Seed Production

(from Page 11)

of desert flora that may be more attractive to bees. For example, peak onion bloom occurs in April and May; the duration and exact time depends on the variety. This is when several desert plants such as mesquite (*Prosopis juliflora*) salt cedar (*Tamarix pentandra*), arrow weed (*Pluchea serica*), and creosotebush (*Larrea tridentata*) also bloom. These desert plants appear to be attractive to honey bees as sources of both pollen and nectar, so problems of poor bee visitation to onion seed fields are probably related to the lower relative attractiveness in onion flowers.

One problem observed was that the bees were slow to start working the onion flowers after the colonies were placed in the field resulting in poor seed set on the early heads. This seemed more of a problem in 1969 than in 1970. Attempts at encouraging the bees by spraying the onions with artificial attractants have given variable results. Until the onion flowers can be made more attractive we suggest that growers continue the practice of bringing in more honey bee colonies when bees are working in the field poorly.

In addition to poorer seed set on early blooms there were some fields in 1969 where the seed crop failure could be attributed mainly to poor bee activity. Bee activity in 1970 was considered good enough for adequate pollination in most fields.

Harvest.

The most common method of harvest was by specially adapted combines (Figure 1) which removed the heads and passed them through a widely spaced cylinder and then transferred them to a large especially-built wagon being pulled along beside the combine (Figure 2). From the wagons the onion heads were dumped onto polyethylene tarps where they were dried in the open for a few weeks before threshing (Figure 3). Such mechanization of the harvest has reduced the cost compared with hand harvesting methods used previously. Also, harvest is completed in a shorter time, thus preventing unnecessary shattering of seed from mature plants ready for harvest.

Conclusions.

Onion seed production in Yuma County can be a profitable enterprise and in general satisfactory cultural practices have been developed. Two areas of uncertainty remain:

- control of plant diseases during cool wet years, such as occurred in 1970
- assurance of an adequate pollinator population in the fields during the time of bloom.

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