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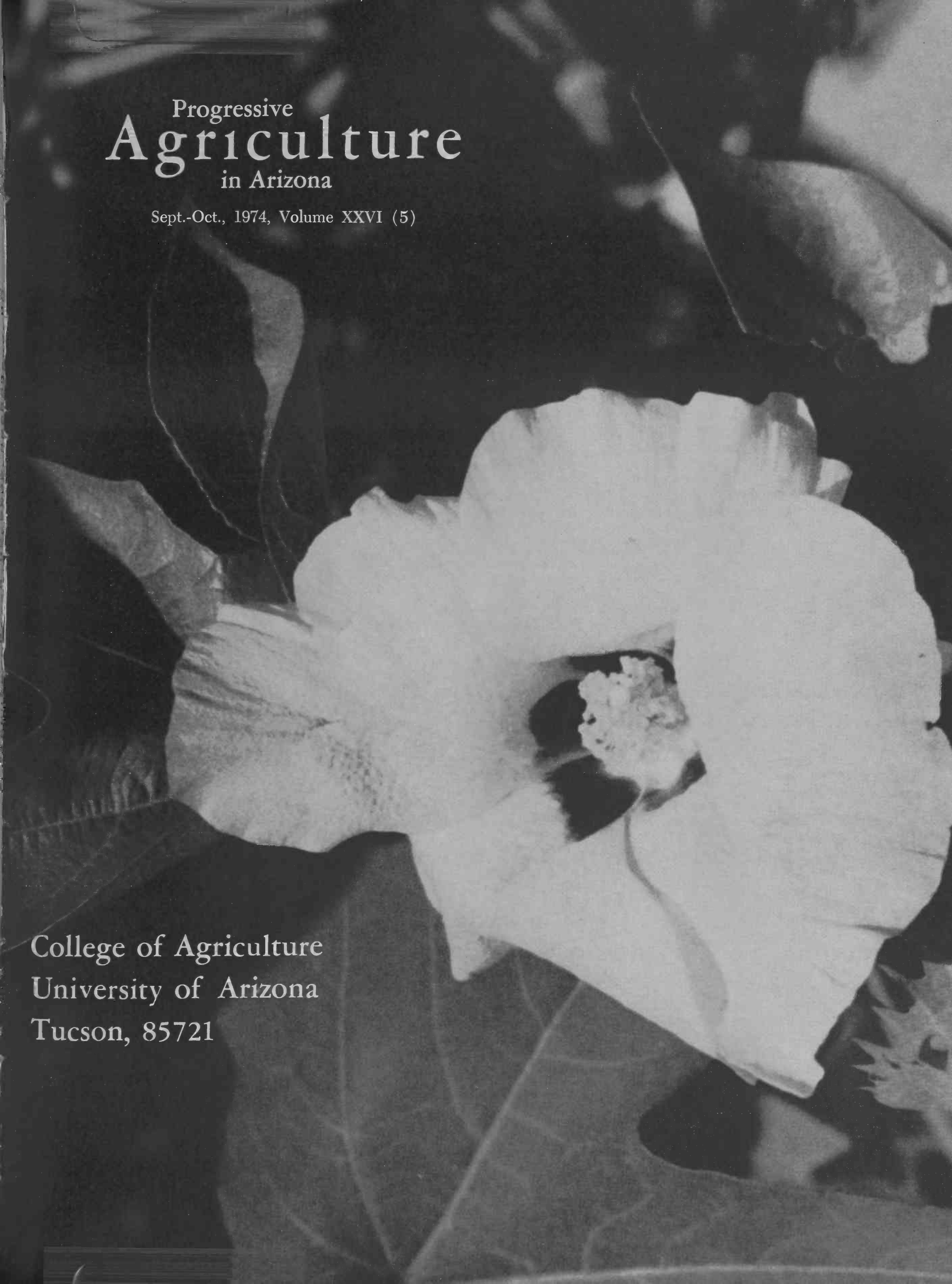

College of Agriculture
University of Arizona
Tucson, 85721

Our Cover . . .

Calls attention to the Pima S-4 long staple cotton flower. It is intended to attract your attention to the article on your right, beginning Page 3.

In this Issue . . .

Progressive Agriculture in Arizona

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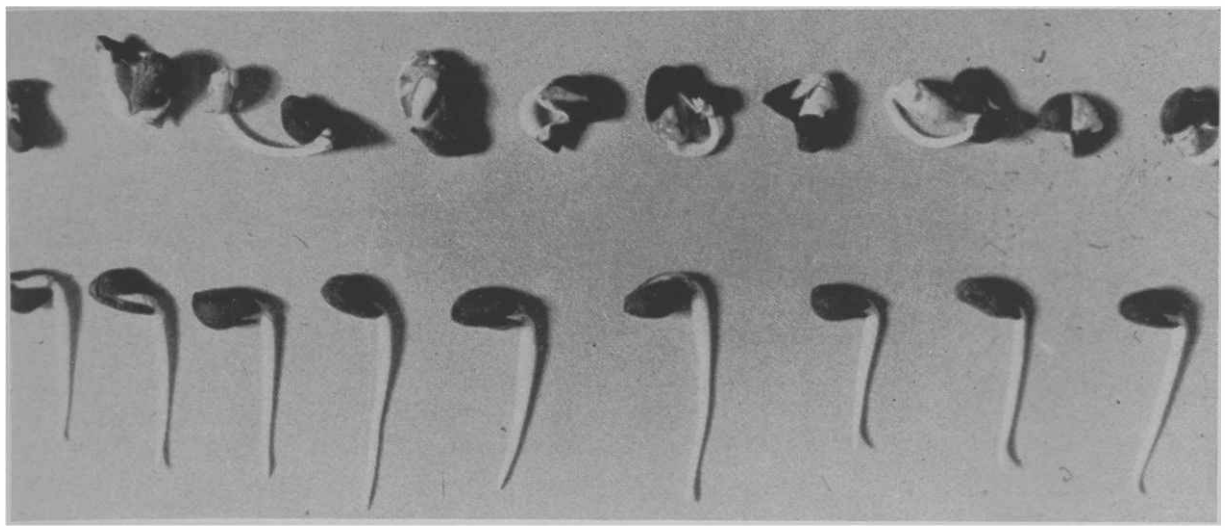

Figure 1. Germination of normal and cracked seed tested in the laboratory.

Relation to Selected Characteristics of Pima S-4 Cottonseed to Quality

by J. E. Wheeler, D. F. Cole, R. G. Sackett[2]

Summary

Studies were conducted using two lots of Pima S-4 cottonseed (*Gossypium barbadense* L.) from Arizona to determine the relationship of selected characteristics to germination and emergence. Each lot was separated into six categories based on color, density, and cuts and cracks in the seed coat. Both lots were quite variable in terms of the seed properties evaluated. The percentages of seed within each category, however, were similar for both lots. Black seed that sank in water composed approximately two-thirds of each lot, had a higher average weight, and performed best in tests designed to determine germination, vigor, and emergence. Cracked and cut black seed composed approximately 20% of each seed lot and were inferior in tests as compared to black seed without cracks and cuts.

Introduction

Pima S-4 cotton (*Gossypium barbadense* L.) accounts for approximately 10% of the yearly planting of cotton in Arizona. Inconsistent germination and poor seedling emergence are major problems confronting growers resulting in substantial monetary losses due to poor stands and additional thinning operations to compensate for overplanting.

Research studies have shown that seed weight, maturity, damage, vigor, and emergence are major factors that should be considered in seed quality (4, 10, 12, 13). Other studies have been made on the influence of soil temperature, planting depth, and seed treatment (7, 9, 11, 12). Researchers have concentrated on the effect of handling, storage, and the inherent properties of the seed including water uptake, hard seedcoat, and dormancy on seed quality (1, 5, 9). This investigation was conducted to determine the influence of selected seed properties upon seed germination and emergence of Pima S-4 in an attempt to pinpoint possible sources of poor seed quality.

Materials and Methods

Two commercial lots of Pima S-4 cottonseed treated with hot water (130-145° F. for 3 min) and PCNB were tested. Lots were labeled 1 and 2, respectively. Seed from six random samples taken from each lot, were divided into six categories based upon color, buoyancy in water, and damage. Uncracked (equals uncut and uncracked) categories were divided into black sinkers, brown sinkers, black floaters, and brown floaters. Cracked or damaged seed were divided into black and brown groups.

Seed from a random sample of 100 ml in volume from each uncracked category were weighed, or if the category equaled a volume of less than 100 ml seed of the entire category,

(Please turn page)

[1] *Contribution from the Department of Agronomy and Plant Genetics, University of Arizona, Tucson, Arizona, and the Agricultural Marketing Research Institute, Agricultural Research Service, USDA, Beltsville, Maryland. This research was supported in part by the SuPima Association of America. Expericent Station No. 2056. Received.*

[2] *Plant Pathologist, International Agricultural Programs, University of Wisconsin, Madison, Wisconsin 53706 (formerly Assistant Agronomist, Department of Agronomy and Plant Genetics, University of Arizona, Tucson, Arizona 85721); Research Plant Physiologist, U. S. Department of Agriculture, Agricultural Research Service, North Dakota State University, Fargo, 58102. (formerly Research Plant Physiologist, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland 20705); Assistant Agronomist, Department of Agronomy and Plant Genetics and Executive Secretary of A.C.I.A., University of Arizona, Tucson, Arizona 85721.*

Table 1. Composition and germination of two lots of Pima S-4 glanded cottonseed (*Gossypium barbadense L.*) when tested in the laboratory.

Seed Category	Lot 1				Lot 2			
	No. per Class	*% of Total*	*Average wt. (mg)*	*Germination[1] %*	*No. per Class*	*% of Total*	*Average wt. (mg)*	*Germination[1] %*
Sinkers black	9992	62.2	144	88.9	10517	65.2	161	96.0
Sinkers brown	375	2.3	120	18.4	295	1.8	113	31.5
Floaters black	1705	10.6	115	67.5	2120	13.5	111	28.0
Floaters brown	111	0.7	104	0.0	111	0.6	107	5.3
Cracked black	3618	22.6	[2]	52.7	2831	17.5	[2]	52.8
Cracked brown	258	1.6	[2]	20.4	238	1.4	[2]	8.0
Total	16058[3]	100.0		76.8	16112[3]	100.0		85.4

[1] *Germination percents are based on approximately ½ of the total seed sample per category for each lot.*
[2] *Not included because of error due to incomplete seed.*
[3] *Represents 6 random samples.*

were weighed and averaged. These seed were tested as described below.

Rate of germination is a measure of vigor (2). Vigor of the seed in each category was determined by germinating seed in a dark, saturated environment at 30 C, counting and discarding those seed having radicles over 1 cm in length each day for the first 7 days. After 7 days, the percent germination was computed for each of the 2 lots and for each of the 6 categories from each lot.

Other seed in each category of the two lots were planted separately 1-1½ inches deep in Gila silt loam soil to evaluate emergence. Gila silt loam is an alkaline soil from Marana, Arizona. Flats containing soil were placed in the greenhouse where the ambient temperatures ranged from 24 to 32 C. Soil was uniformly watered as needed. Seedlings were counted at 6 and 12 days.

Results and Discussion

The two seed lots were similar in composition based on the criteria used (Table 1). Seed color is the most decisive criterion for seed germination and emergence; i.e., black seed (mature seed) were superior to brown seed within the respective categories of sinkers, floaters, and cracks (Table 1). Brown or light colored seed are known to be immature (13), and inferior and should be excluded when possible. Immature or brown seed were not the major cause of poor germination and emergence because they composed only 4.6% and 3.8% for samples from lots 1 and 2, respectively (Table 1).

Comparison among the categories of black seed reveals that cracked seed are the poorest in germination (Fig. 1), and floaters are inferior to sinkers. However, the cracked seed appear as the category contributing most to poor germination of each seed lot because: it composes 23% of lot 1 and 18% of lot 2, and only germinates at an approximate rate of 50% in lab-

Table 2. Percent of germinated seed of Pima S-4 glanded cotton (*Gossypium barbadense* L.) having radicles at least 1 cm long for each day during 7 days when tested in the laboratory.**

Seed Category	Lot 1 Days								Lot 2 Days							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*Total No. of Seed Germinated*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*Total No. of Seed Germinated*
Sinkers black	0.9	78.7	16.3	3.3	0.4	0.4	0.0	4881	2.4	84.5	9.6	2.9	0.4	0.2	0.0	5342
Sinkers brown	0.0	55.5	38.9	2.8	2.8	0.0	0.0	36	0.0	73.6	20.7	3.8	1.9	0.0	0.0	53
Floaters black	2.0	61.2	26.4	8.2	2.2	0.0	0.0	513	2.3	66.7	21.5	6.4	2.3	0.0	0.8	657
Floaters brown	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	2
Cracked black	0.9	62.1	27.8	6.7	1.7	0.8	0.0	867	1.7	60.3	27.4	8.7	1.1	0.8	0.0	652
Cracked brown	0.0	52.6	42.1	5.3	0.0	0.0	0.0	19	0.0	50.0	25.0	25.0	0.0	0.0	0.0	4
Percents per lot	1.0	74.8	18.9	4.2	0.7	0.4	0.0	6316	2.3	80.2	12.6	3.8	0.7	0.3	0.1	6710

** *Percents based upon the number of seed germinated per category. Three random samples per lot were tested.*

Table 3. Percent emergence of Pima S-4 glanded seed (*Gossypium barbadense* L.) from Gila silt loam soil at 6 and 12 days.[1]

	Emergence 6 Days		*Emergence 12 Days*		*Total Emergence*	
Seed Category	*Lot 1*	*Lot 2*	*Lot 1*	*Lot 2*	*Lot 1*	*Lot 2*
Sinkers black	**88.8**	**94.8**	**4.1**	**3.2**	**92.9**	**98.0**
Sinkers brown	**39.1**	**41.7**	**5.0**	**5.5**	**44.1**	**47.2**
Floaters black	**89.5**	**92.5**	**3.5**	**7.5**	**93.0**	**100.0**
Floaters brown	**13.2**	**17.8**	**0.0**	**0.0**	**13.2**	**17.8**
Cracked black	**65.7**	**60.7**	**5.5**	**7.3**	**71.2**	**68.0**
Cracked brown	**51.2**	**47.3**	**1.2**	**15.8**	**52.4**	**63.1**
Totals per lot	**80.4**	**85.2**	**4.3**	**5.1**	**84.7**	**90.3**

[1] *Seed were planted 1-1½ inches deep in Gila silt loam from cotton field at Marana, Arizona. Three random samples per lot were tested.*

oratory studies (Table 1), and furthermore, it is the only class in which poor germination and emergence can be related to harvesting, ginning and seed processing.

Rate of germination of a given seed category is based only on those seed that germinated (Table 2). Black seed are more vigorous than brown seed within sinker, floater, and cracked categories (Table 2), and black cracked seed are approximately equal in vigor (based on germination speed) to black floaters, both being inferior to black sinkers.

At 2 days there is an 8 and 15% superiority in vigor of the black floaters and sinkers of lots 1 and 2, respectively, indicating that cracking (perhaps additional processing such as hot water treatment) does decrease vigor.

When seed were planted in Gila silt loam soil, germination and emergence were slightly higher than that obtained in the laboratory for both lots (Table 3). Again, lot 2 was superior to lot 1 after 6 and 12 days. Black seed were superior to brown seed within the categories of sinkers, floaters, and cracked seed. Other work (12) has shown that plant survival and yield is most highly correlated with emergence time and to a lesser degree with germination percentage. Increased germination of the two lots in Gila silt loam as compared to germination in the laboratory is reflected in every class (Tables 1 and 3).

Black seed that sink in water are clearly superior seed (Table 1). Higher seed density has a significant influence on total germination and earliness (10). The effect of higher density on germination is clearly shown when black sinkers are compared to black floaters. In every experiment black floaters germinated at a lower rate than black sinkers. Higher density was not sufficient to overcome the effect of immaturity as revealed by comparison of the performance of black sinkers with brown sinkers. The contribution of seed weight cannot be excluded from seed density since black sinkers were the heaviest seed. However, some workers were unable to show a yield difference from seed separated by weight (6), while other workers have shown that rate of growth (vigor) is a positive function of greater seed weight (10). Our experiments were not designed to make this distinction.

Black seed are superior to brown seed or immature seed (13) regardless of density or damage, thus answering the question of which of the criteria is most critical (Table 1). Brown seed composed less than 5% of the total per lot, thus rendering them only a minor contributor to poor seed quality. The more important question is then, what seed contributed most to low viability in a given Pima S-4 seed lot.

Study of the data from black seed reveals that cracked black seed composed a much greater portion of the seed than the black floaters (lot 1, 22.6 vs. 10.6%; lot 2, 17.5 vs. 13.5%). Since the cracked black seed had much lower percentage germination (Table 1) and emergence (Table 3), Pima S-4 seed lots can be most significantly improved by avoiding cracked or damaged seed.

Uniformity of seed lots has been emphasized by several workers (3, 8, 10). Seed uniformity is thought to be necessary for precision planting leading to more uniform stands which facilitate the most successful cultural practices (8, 10, 13). These data illustrate the great lack of seed uniformity due to maturity, density, damage, and inadequate processing. This lack of uniformity is translated into great differences in germination, vigor, and emergence. In the 2 lots of Pima S-4 tested, it would appear that the most feasible way to improve seed uniformity would be to exclude cracked seed. This is derived from the knowledge that immaturity is a difficult factor to control, and that immature seed make up only a small portion of each lot. In addition, floaters comprise a smaller percentage of each lot than do the cracked black seed and have higher rate of seedling emergence.

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Money Spent For Beef And Pork

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

Rising food prices and large increases in the total grocery bill have been and continue to be a major concern of U.S. consumers. Many of the concerns and much of the news coverage on food costs have focused on retail beef and pork prices. One reason for this is that meat accounts for roughly one-third of the total spent for food, and beef and pork are the two major meat products consumed in the U.S.

Sharp Rise in Total Dollars Spent for Beef and Pork

Approximately 15 years ago — back in 1960 — the amount of money Americans spent for beef averaged $50.51 per year per person (Table 1 and Figure 1). Expenditures for beef per person increased about $3 per year, and reached $82.96 by 1970. Consumer expenditures for beef increased further to an average of almost $110 per person by 1973, more than double the 1960 amount. It appears the 1974 beef expenditures will average at least $120 per person.

The annual average cost of pork per person increased from $34 in 1960 to $63 in 1973. For the year 1974, it is estimated that this will climb to about $72 per person.

These increases in beef and pork expenditures have occurred primarily because of (1) upward trend in quantities purchased and consumed and (2) rising retail prices.

Table 1. Per Capita Income and Expenditures for Beef and Pork, U.S.

Year	*Disposable Income per Person*[1]	*Money Spent per Person for* Beef	Pork[2]	*Proportion of Income Spent for* Beef	Pork
	Dollars			*Percent*	
1960	1,937	50.51	33.74	2.6	1.7
1965	2,436	58.98	35.92	2.4	1.5
1970	3,376	82.96	48.17	2.5	1.4
1971	3,603	87.13	47.73	2.4	1.3
1972	3,816	97.69	52.15	2.6	1.4
1973	4,187	109.80	62.90	2.6	1.5
1974[3]	1,103	30.02	17.97	2.7	1.6

[1] *Income after payment of personal taxes.*

[2] *Based on retail weight of consumption times average retail price for pork and for Choice grade beef. Conversion factors of .74 for beef & .93 for pork were used to adjust carcass weight consumption to retail weight consumption.*

[3] *Income and expenditures for 1974 are for first quarter.*

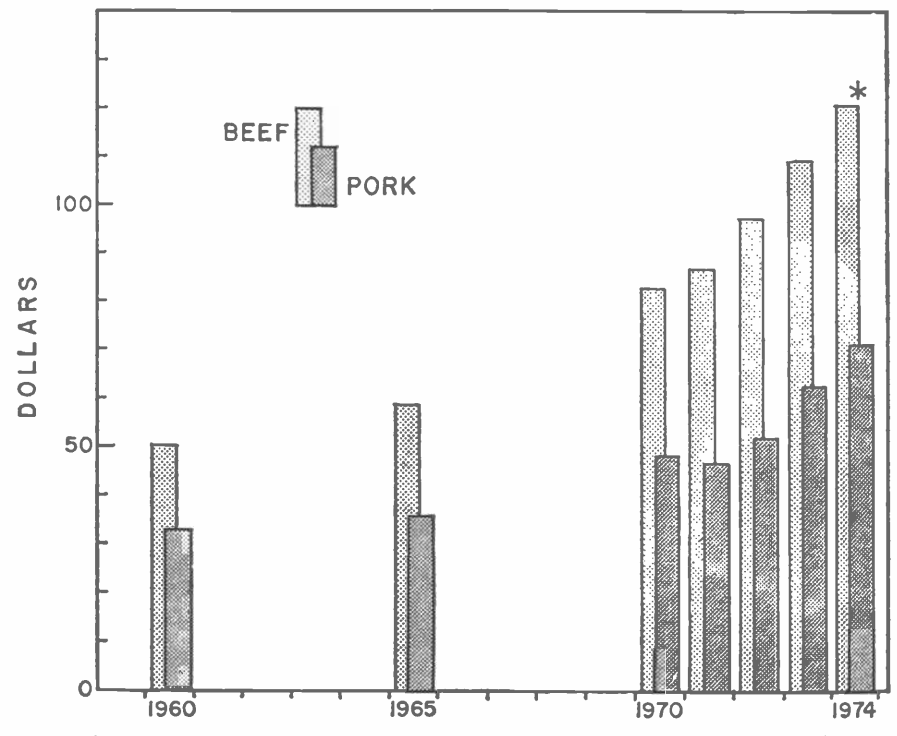
Trends in Per Capita Consumption of Beef and Pork

U.S. consumption of beef in 1960 averaged 85 pounds per person, and pork consumption averaged 65 pounds (Figure 2). By 1972, per capita beef consumption had risen to an all time high of 116 pounds, but then declined to 109 pounds in 1973.

Following the pronounced upward trend during the 1960's, per capita beef consumption has remained fairly stable at 110-115 pounds during the early 1970's. Typically, the U.S. has consumed almost all of the nation's beef output, plus some imported beef products. Thus, the leveling-off in per capita beef consumption may have been due more to lack of supply than to a limit of consumers desires.

In addition to the increase in the quantity consumed per person, there was an appreciable upgrading in the quality of beef produced and consumed in the U.S. In 1960, 41 percent of the U.S. beef output was Prime and Choice grades (Table 2). By 1972, these two top grades of beef accounted for 64 percent of total production. This improvement in quality has raised the cost of producing beef, which in turn has exerted upward pressure on retail beef prices.

Figure 1. Expenditures per Person for Beef and Pork, U.S.

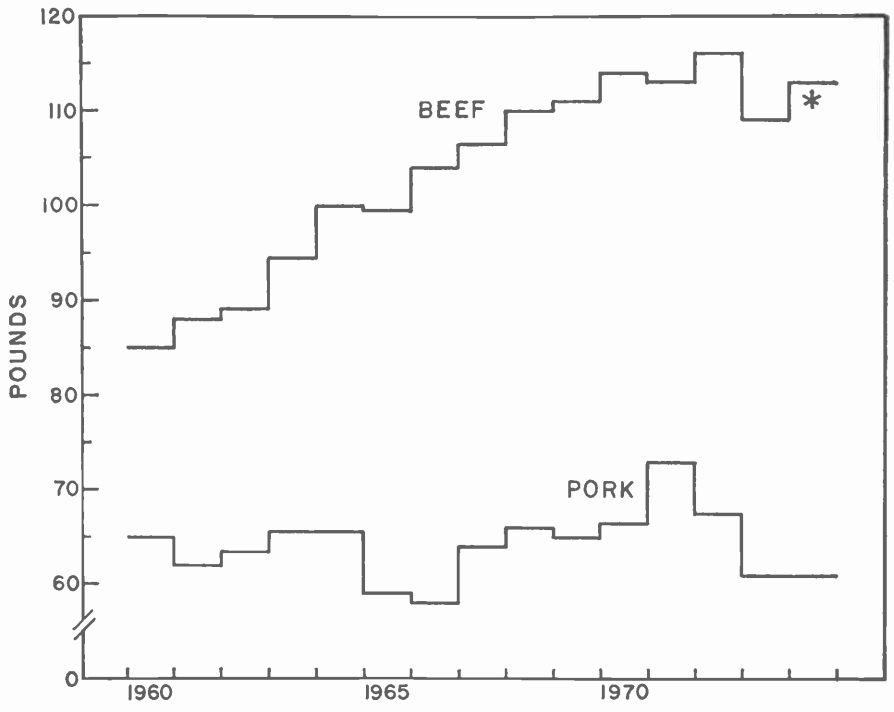


* Estimated for year on basis of 1st quarter expenditures of $30.02 for beef and $17.97 for pork.

*Marketing Specialist, Cooperative Extension Service, and Professor Department of Agricultural Economics, University of Arizona.

Note: Data used in this article, including tables and charts, are from U.S. Department of Agriculture, LIVESTOCK AND MEAT SITUATION, LMS-196, May 1974; and U.S. Department of Agriculture, 1973 HANDBOOK OF AGRICULTURAL CHARTS, Agriculture Handbook No. 455, October 1973, p. 77.

Figure 2. Consumption of Beef and Pork per Person, U.S. (carcass weight)



* Estimated for year on basis of first quarter consumption.

In contrast to the pronounced and steady increase in per capita beef consumption, per capita pork consumption varied from 58 to 66 pounds annually during the 1960's. Consumption averaged 73 pounds per person in 1971, but had declined to 61 pounds two years later.

Table 2. Percentage Distribution of U.S. Beef Production by Grade, Selected Years.

Year	*Prime*	*Choice*	*Good*	*Standard and Commercial*	*Utility, Canner & Cutter*
		Percent of Total			
1960	4	37	28	13	18
1965	4	47	17	12	20
1970	4	59	16	8	13
1971	4	59	16	8	13
1972	4	60	16	8	12

Big Increase in Retail Prices

During the eight years 1960 through 1967, the U.S. average retail price for all cuts of Choice grade beef remained fairly stable at near 80 cents per pound (Figure 3). Thus, practically all of the increase in the money spent per person for beef during these years was due to increased consumption.

However, from 1967 to 1970, the U.S. average retail price for Choice Beef rose from 83 cents to 99 cents per pound, an increase of 16 cents per pound. Then, during the next three years, prices increased another 37 cents to an average of $1.36 per pound for 1973. Thus, almost all of the increase in money spent per person for beef since the late 1960's has been due to the increase in retail prices, because consumption has remained fairly stable during this period.

Retail pork prices remained fairly stable at 55 to 60 cents per pound during the early 1960's. From 1965 through 1972 average retail pork prices ranged between 66 and 83 cents per pound. But, in 1973 the average price increased to $1.10 per pound.

Over the entire 15 years from 1960 to 1974, almost all of the increase in money spent for pork has to be attributed to increases in retail prices. Consumption had little effect on pork expenditures since consumption remained fairly stable at approximately 65 pounds per person.

Peoples Incomes Are Rising, Too

The large increases in expenditures per person for beef and pork have been possible primarily because of comparable increases in per capita disposable incomes. Disposable income is the money individuals have left after paying personal taxes which can be used for buying food and other goods and services.

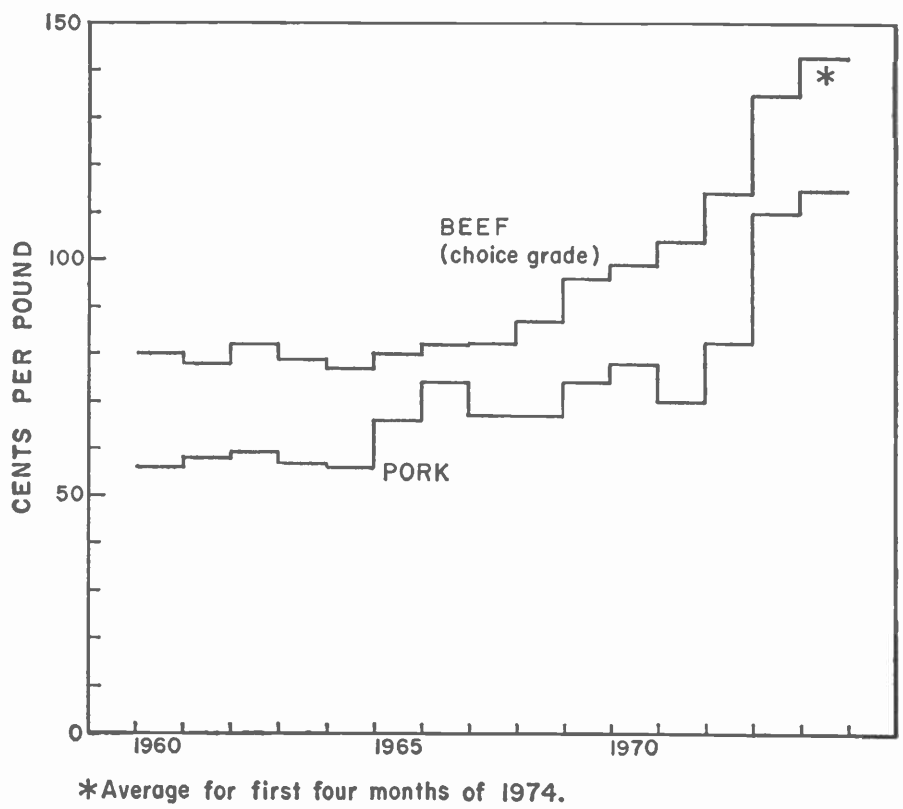
Disposable income per person has risen from $1,937 in 1960 to $4,187 in 1973 (Table 1). This is an increase of 116 percent. During the same period, money spent per person increased 117 percent for beef and 86 percent for pork. The combined expenditures for beef and pork increased 105 percent, which is less than the 116 percent increase in disposable income per person.

Proportion of Incomes Spent for Beef and Pork

Although total dollars spent per person for beef and pork in 1973 was double the dollars spent in 1960, there was little change in the *percent* of disposable incomes used for these two food products during this 14-year period. In 1960, U.S. consumers spent an average of 2.6 percent of their incomes for beef and 1.7 percent for pork (Table 1). In 1973, 2.6 percent was spent for beef and 1.5 percent for pork.

During the period 1960-1973, people increased their beef consumption by an average of 25 pounds per person, and continued to eat about the same amount of pork. Thus, on an average U.S. consumers were able to appreciably increase the total amount of beef and pork in their diets without spending a greater proportion of their incomes for these meats.

Figure 3. Average Retail Price per Pound for Beef and Pork, U.S.



*Average for first four months of 1974.

Progress toward development of . . .

Phytophthora Root Rot Resistant Alfalfa for Arizona

*by R. B. Hine, F. A. Gray, M. H. Schonhorst and J. S. Sanders**

During 1968 and 1969, in several large field trials in Arizona, Schonhorst, et al. (4), demonstrated that their new alfalfa cultivar Hayden, which was developed by crossing two top forage-producing clones of the cultivars Sonora-70 with two clones of Mesa-Sirsa, outyielded Mesa-Sirsa, El-Unico, and Sonora, three of the most widely planted nondormant alfalfas in Arizona, by approximately 10 to 20%. This new cultivar was also shown by Nielson, et al. (3), to have a high degree of resistance to the most common biotypes of the spotted alfalfa aphid. Hayden, presently, is the most widely planted cultivar in Arizona, comprising approximately 50% of all new plantings in the State. Studies initiated in 1970, however, indicated that this popular cultivar, as well as other nondormant alfalfas, was susceptible to root rot caused by the fungus *Phytophthora megasperma* (2,3). This disease was shown to be an important factor in stand and yield decline of alfalfa in Arizona. Because of the excellent agronomic characteristics of Hayden, research was initiated in 1970 to increase resistance in this cultivar to *Phytophthora* root rot. Gray, et al. (1), demonstrated that incidence of seedling disease caused by *P. megasperma* could be altered by manipulating inoculum level and temperature. Increased resistance to seedling disease was described in a germplasm derived from this screening method. However, it was emphasized that the efficacy of the screening method was dependent upon reaction of the resistant germplasms to root rot in field situations.

Studies were initiated, then, to determine: (i) what level of field resistance to root rot had been achieved using germplasm obtained from the seedling greenhouse selection technique; (ii) if levels of resistance differed between first-and second-cycle selections; and (iii) if these selections were resistant to isolates of *P. megasperma* from different geographical areas in Arizona.

Field studies — Several experimental and commercial alfalfa entries were tested for resistance to *Phytophthora* root rot in three field trials at the University of Arizona Campbell Avenue Farm in Tucson. Experimental University of Arizona entries developed in the previously described seedling greenhouse method included: Hayden PX I (a first-cycle polycross from Certified Hayden), Hayden PX II (a second-cycle polycross from Certified Hayden), Mesa-Sirsa PX I (a first-cycle polycross from field-selected plants), and Hayden polycross I, modified. Lahontan and Certified Hayden, and Certified Mesa-Sirsa,

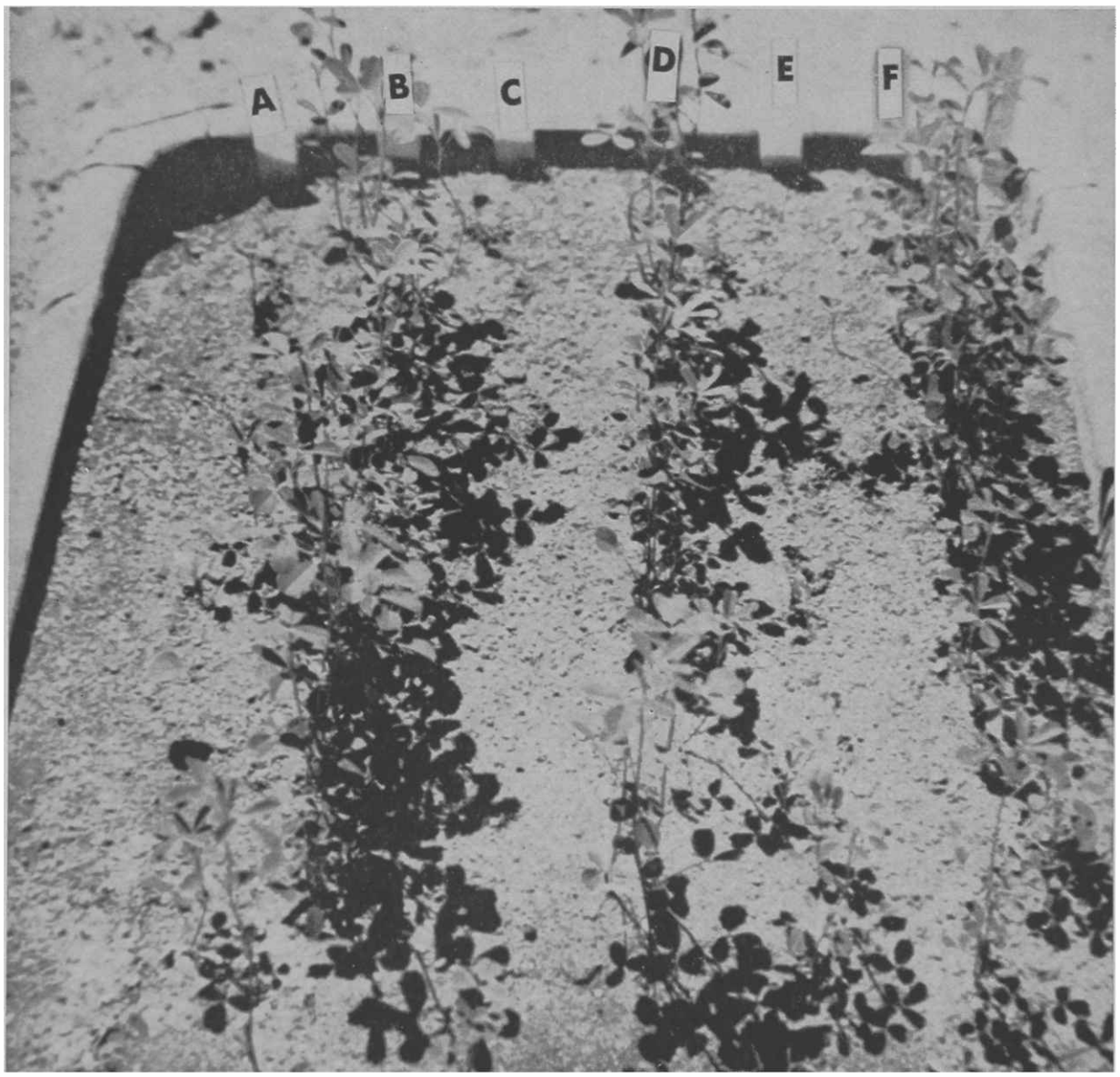


Figure 1. A comparison of growth and survival of the cultivar Hayden (rows A, C, E) with Hayden PX II (rows B, D, F) after 10 weeks of growth in soil infested with Phytophthora megasperma.

**First, second, and fourth authors are Professor and Research Assistants, respectively, Department of Plant Pathology; third author is Professor, Department of Agronomy and Plant Genetics, University of Arizona, Tucson 85721.*

The authors thank Dr. Mervin W. Nielson, Entomologist, U.S.D.A., Tucson, for determination of resistance levels in the alfalfa cultivars to the spotted alfalfa aphid.

Table 1. Field resistance to *Phytophthora* root rot in two experimental alfalfa germplasms in comparison with one resistant (Lahontan) and two susceptible (Hayden, Mesa-Sirsa) cultivars.

Entries	Stand[a] Density	Plant Height	Root disease rating[b] (Percent of plants in each category) 1	2	3	4	5	Total Plants Examined
Hayden PX II	**1.4**	**1.0**	**83.9**	**8.7**	**7.1**	**0.0**	**0.3**	**311**
Hayden PX I, modified	**2.2**	**1.2**	**62.4**	**17.8**	**12.7**	**6.6**	**0.5**	**197**
Hayden	**2.6**	**2.2**	**28.4**	**31.8**	**22.7**	**15.9**	**1.1**	**176**
Lahontan	**3.0**	**2.8**	**55.9**	**28.6**	**9.3**	**6.2**	**0.0**	**227**
Mesa-Sirsa	**3.4**	**2.6**	**22.4**	**31.9**	**21.4**	**14.8**	**9.5**	**210**

[a] *Score of 1.0 indicates excellent stand and growth; 5.0 indicates poor stand and stunted growth. These scores are means of five replications.*

[b] *Score of 1 = disease free; 2 = no obvious root lesions but fine roots destroyed, leaving small lesions at point of attachment; 3 = distinct lesions on taproot; 4 = many elongated lesions on taproot; 5 = nearly all of taproot rotted.*

were included as resistant and susceptible checks, respectively. Hayden PX I seed was produced by interpollinating 100 surviving seedlings of approximately 10,000 original Hayden seedlings exposed to the *Phytophthora* fungus. Hayden PX I seed was again screened in the greenhouse using the same technique, and 125 of the most vigorous, disease-free seedlings were selected from a population of approximately 6000 plants. These plants were interpollinated by bees in the greenhouse and the seed designated as Hayden PX II. These 125 clones were also propagated and planted in replicated plots in an infested field at Tucson. After 1 year, 35 of the most vigorous and disease-free clones were allowed to interpollinate and the seeds from them designated HPX I, mod.

In the first test, seeding was made at the rate of approximately 40 lbs./acre in 10 x 10 sq. ft. plots replicated five times. This site was naturally infested with *P. megasperma.* In test two the same entries were planted, but the field was artificially infested with isolates of *P. megasperma* from diseased alfalfa from Buckeye, Gilbert, and Laveen. Each entry was replicated six times in 10 x 10 sq. ft. plots. The third test consisted of 25 commercial and experimental entries planted in single-row plots replicated five times. All three plots were established during October 1973, irrigated weekly, and evaluated in June 1974 for stand density, vigor, and incidence and severity of root rot. Approximately 200 plants were dug from each replication, washed, and observations made on root disease.

A heat-pasteurized soil-sand mixture was used for all pathogenicity experiments in the greenhouse. In most studies, growth chambers were maintained on a 12-hour light cycle at 24 C and a 12-hr. dark cycle at 18 C. Temperatures in glasshouse studies were maintained at 24-27 C. Daily watering of all experiments insured a high soil-moisture condition. Saucers placed under all pots were kept flooded for 2 weeks and then removed. All experiments were replicated four or more times and repeated at least twice. Stand counts were taken 2 to 12 weeks after planting.

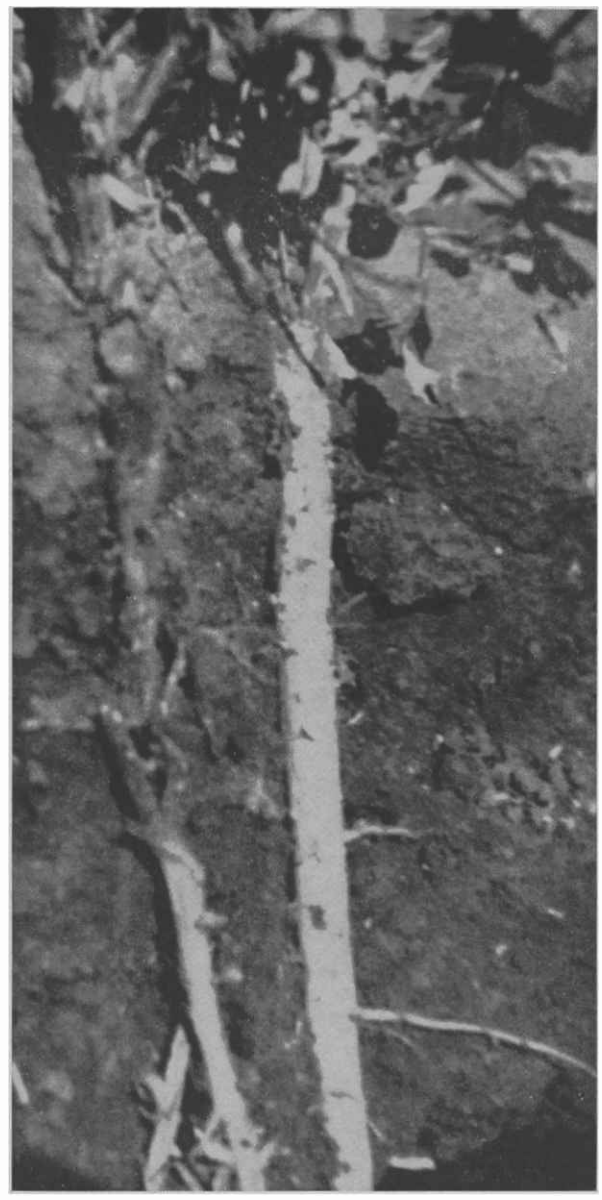


Figure 2. Infected and healthy roots of alfalfa plants grown under field conditions.

RESULTS AND DISCUSSION — In three field trials Hayden PX II was the entry most resistant to *Phytophthora* root rot. In one study Hayden PX II, Hayden PX I, and Hayden had 83.9, 62.4, and 28.4% resistant plants, respectively, 8 months after planting (Table 1). Hayden PX II also had the highest density and plant height ratings. Both Hayden PX I and II had more resistant plants than Lahontan, which was used as a resistant check. Mesa-Sirsa, a commonly planted nondormant variety, was the most susceptible entry with only 22.4% resistant plants. Plants in root disease categories 3, 4, and 5 were considered to be highly susceptible. The percentage of plants in these categories was: Hayden PX II, 7.4; Hayden PX I, modified, 19.8; Hayden, 39.7; Lahontan, 15.5, and Mesa-Sirsa, 45.7 (Table 1).

In another study consisting of two field tests, after 8 months Hayden PX II, Lahontan, Hayden PX I, and Certified Hayden had 66.7, 59.9, 40.6, and 14.8% resistant plants in a naturally infested field site and 79.4, 78.4, 58.5, and 41.5% resistant plants in an artificially infested site, respectively (Table 2). In a general appearance rating (1.0 indicates excellent stand and growth, and 5.0 indicates poor stand and stunted growth) Hayden PX II, Hayden PX I, Lahontan, and Certified Hayden had ratings of 1.25, 2.50, 3.00, and 3.75, respectively (Table 2).

Several studies were designed to determine if the Hayden polycross germplasm, which was resistant to isolates of *P. megasperma* used in the original screening work (Buckeye, Laveen, Gilbert), would show similar resistance to isolates from other areas in Arizona. Isolates used in these studies

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were recovered from diseased taproots of alfalfa from widely separated geographical areas in Arizona: Parker (west-central), 140 m elevation; Yuma (southwest), 47 m elevation; Snowflake (north-central), 1860 m elevation; Safford (southeast), 973 m elevation; Tucson (south-central), 796 m elevation; and Many Farms (northeast), 1766 m elevation. None of these isolates were used in the original greenhouse screening studies.

Each of the flats was seeded with three rows each of scarified seed of CH and HPX II (100 seeds/row). Each flat was considered a replication. In a test typical of several, it was shown that Hayden PX II was as resistant to the isolate from Snowflake as it was to the isolate from Buckeye. The average number of surviving seedlings/row after 10 weeks in the Hayden PX II resistant germplasm was 40.4 and 38.8 with the isolates from Snowflake and Buckeye, respectively. In the susceptible cultivar Certified Hayden, surviving seedlings/row were 8.8 and 5.3, with the isolates from Snowflake and Buckeye. Surviving seedlings of Certified Hayden were mostly stunted with numerous taproot lesions, whereas the surviving seedlings of Hayden PX II were vigorous and essentially free of root rot. Similar data were collected from several pot tests with different isolates of *P. megasperma*. In one test the pathogenicity of equal mixtures of the three isolates from Buckeye, Laveen, and Gilbert was compared with the isolates from Snowflake and Tucson. Hayden PX II was equally resistant to the isolates from Tucson and Snowflake as it was to the three isolates from Buckeye, Laveen, and Gilbert when data were taken 8 weeks after inoculation of 11-day-old plants. In this study, which was repeated twice, the Tucson isolate was more virulent than the other isolates. Similar results were obtained in pot studies with isolates from Safford, Yuma, Parker, and Many Farms.

The information presented in this paper validates the greenhouse seedling screening technique as an effective method for increasing the level of resistance of mature alfalfa plants in the field to *Phytophthora* root rot. Under optimum conditions for disease in the field, resistance was increased from less than 15% in the starting population to about 60% in the first cycle of selection and then to about 83% after two cycles of selection.

Table 2. A comparison of field resistance in two experimental alfalfa germplasms to *Phytophthora* root rot in naturally and artificially infested sites.

Sites[a]	*Entries*			
	HPX II	*HPX I*	*LAHONTAN*	*HAYDEN*
1 — Resistant plants	505[b]	360	762	209
Susceptible plants	131	255	210	295
Percent resistant plants	79.4	58.5	78.4	41.5
2 — Resistant plants	314	185	273	58
Susceptible plants	157	271	183	334
Percent resistant plants	66.7	40.6	59.9	14.8
General appearance score	1.25[c]	2.50	3.00	3.75

[a] *Site 1 was seeded and artificially infested with PHYTOPHTHORA MEGASPERMA as described in the text on 1 Oct. 1973 and evaluated on 14 June 1974. Site 2 was seeded on 2 Oct. and evaluated on 13 June 1974. This site was naturally infested, and disease incidence was high in a previous planting.*

[b] *Total number of plants dug from five replications in site 1 and four replications in site 2. Resistant plants were free of taproot lesions.*

[c] *Score of 1.0 indicates excellent stand and growth; score of 5.0 indicates poor stand and stunted growth. The scores are means of four replications.*

According to researchers in Minnesota a low frequency of resistant genes occurs in many susceptible alfalfa cultivars. This probably explains our ability to successfully select resistant seedlings in large populations of a susceptible cultivar, such as Hayden. Our work in Arizona is similar to that in Minnesota in that our resistant germplasms are resistant to isolates of *Phythophthora* from different areas in Arizona, an important factor in adaptability of a new alfalfa cultivar to the various geographical locations in Arizona. Presently, seed of the resistant germplasms are being produced at the University Farm at Yuma and Marana so that large-scale field trials for forage production and disease resistance can be made in several areas in Arizona.

Hayden PX II was shown to have the same level of resistance as Certified Hayden (unpublished data) when seedlings were exposed to biotypes of the spotted alfalfa aphid. This level of insect resistance is necessary for release of a new cultivar in Arizona.

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[5] *Schonhorst, M. H., R. K. Thompson, and R. E. Dennis. 1971. Hayden alfalfa. Arizona Agri-File Field Crops 272.1.*

Table 3. Comparative effects of isolates of *Phytophthora megasperma* on survival and growth of Certified Hayden and Hayden PX II in greenhouse pot studies.

Isolates	*Entries*	*Average Plants/Pot*[a]	*Average Fresh Wt./Pot (g)*[b]
Tucson	CH	3.1	0.7
	HPX II	6.9	14.2
BLG[c]	CH	4.2	5.1
	HPX II	7.8	16.3
Snowflake	CH	6.1	6.4
	HPX II	9.6	15.8
CK	CH	10.0	25.8
	HPX II	10.0	24.1

[c] *Inoculum consisted of an equal mixture of the isolates from Buckeye, Laveen, and Gilbert.*

[b] *Plants cut off 20 mm above soil line.*

[c] *Inoculum consisted of an equal mixture of the isolates from Buckeye, Laveen, and Gilbert.*

The Impact of Social Security

on Retirement in Relation to Other Forms of Income

*by Pamela J. Pullman**

Social Security Program

The basis for the social security program is an age-old heritage founded in America's beginnings, yet the idea behind it had been misinterpreted through the years. Social security is meant only to supplement a retirement income and not to totally compensate for it; therefore, it is necessary to plan a retirement program which includes social security benefits and other income supplements, keeping in mind the growing rate of inflation. The lack of information and preparation for retirement by the elderly has become a national concern and will soon become a major crisis if steps are not taken to re-evaluate the social security program.

In the past few decades, the individual has found it very difficult to provide for his own security, due mainly to the Great Depression of the 1930's. In 1934, the Committee of Economic Security reported to President Roosevelt that a program of economic security "must have as its primary aim the assurance of an adequate income to each human being in childhood, youth, middle age, or old age — in sickness or in health. It must provide safeguards against all of the hazards leading to destitution or dependency."[1]

The Social Security Act was signed by the President in 1935. It contained the allocation of federal grants to states for old age assistance and contributory old age retirement insurance at the age of 65. It is interesting to note that the age 65 was never in discussion; it just seemed reasonable. Although there was no economic, social, or gerontological reason for a retirement age of 65, no alternative age was ever suggested during the original drafting of the Social Security Act. The program was called Old Age and Survivor's Insurance (OASI). The first monthly retirement benefits, payable in January 1942, were based on the total lifetime covered wages of the contributors with a minimum monthly benefit of $10.00 and a maximum benefit of $85.00.[2]

The social security eligibility test stipulated that "for any month in which the individual received covered 'wages' from regular employment, monthly old age benefits would not be paid."[3] Regular employment was defined as earning more than $14.99 a month. In 1950, that price was raised to $50.00 a month (or $600.00 a year) with no exemptions for those 75 or over. In 1954, the social security test was changed to increase the basic exemption of $1,000 to $1,200 a year and to reduce from 75 to 72 years the age at which full benefits would be payable, no matter how much income was earned.

In 1969, the President sent Congress some recommendations for social security legislation. Gerald Ford introduced these to the House as H.R.24080. This bill was attached to a tax legislation which was passed by the House and the Senate as the Tax Reform Act of 1969. The bill, which provided a 15 percent increase in social security benefits, to be effective January 1970, sets the minimum benefits at $100 a month, reduces benefits payable at age 60 for workers' wives, husbands, widows, widowers, and parents, and increases the allocation of the contribution income to the disability insurance trust fund which began in 1954.

The most important social security legislation passed since the original Act of 1934 is H.R.1. After the House and Senate debated various issues, it was passed October 17, 1972 and signed October 30, 1972. The major components of this bill are:

1. Higher benefits for aged widows and widowers,
2. Equalization of payments and requirements for men and women,
3. Increased earnable amounts, before benefits are reduced, from $1,680 to $2,100,
4. Special minimum benefits for those covered but at low earnings.
5. Higher benefits for workers who wait until after 65 and remain at work before collecting social security,
6. Increased social security benefits 20 percent,
7. Provisions for keeping the social security benefit amounts up to date automatically in the future as the cost of living rises,
8. Increased maximum amount counted toward social security from $9,000 (1972) to $10,800 (1973) to $12,000 (1974).[4]

Number 7. is the key point to this bill, for this country's economic situation is constantly changing, leaving those people with fixed incomes inadequately prepared to face the higher cost of living. After signing the bill, President Nixon remarked that the value of this act is found in the ". . . automatic adjustment provisions which will allow basic payments to keep pace with the cost of living, thus protecting our older citizens against the ravages of inflation."[5]

[To exemplify the difficulty in keeping figures up-to-date, this report was in its final stages when a new bill was passed in Congress. This social security legislation will raise the previous increased taxable wage base from $10,800 to $12,200. H.R.1 set the base at $10,800 for 1973. This figure was to increase in $12,000 in 1974, but this new bill will increase the 1974 wage base to $13,200. As reported in an AP story in Tucson Citizen, Oct. 31, 1974, the base for 1975 will be $14,100.)

The mechanics of the social security program can be briefly stated: em-

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**Senior in Family Economics and Home Management, University of Arizona.*

ployees, employers, and self-employed persons pay social security contributions which are pooled into three funds (hospital insurance, death or disabiilty, and retirement) with a voluntary medical insurance option. In 1939, the social security program covered only the workers in retirement. Since then, it has been extended to cover almost any job in the United States, including the self-employed, state and local employees, household and farm employees, members of the armed forces and clergymen. Those not covered in this program are self-employed doctors of medicine, housewives, and certain self-employed people who are not working in jobs covered by social security or are earning less than $50 in a three-month period.

The amount of contributions a person makes depends on his wage or salary. At the present, employees and employers pay 5.85 percent on the employee's wages, and the self-employed pay three-fourths of the combined employee-employer fund or 8.0 percent. Increases are planned for 1981 and 1986. To receive benefits, a worker must have credit for a certain amount of work done after 1946 under social security. For example, if you reach 62 in 1975, you need 6 years of work to receive credit. Benefits are calculated on the basis of average earnings covered by social security. Because of lower maximum earning levels covered in the past, the full amount of earnings on the present level can not be paid but must be averaged with the lower monthly payment levels. If retirement is taken before age 65, monthly benefits are reduced to account for more years of receiving benefits. Social security payments will be reduced if the retiree under 72 returns to work and earns more than $2,100 a year. For every two dollars earned over $2,100, one dollar in benefits is withheld. This means it is possible to earn up to $175 a month without effecting monthly social security benefits. Income from savings, investments, pensions, insurance, or royalties do not effect social security benefits.

The Economic Position Of the Aged

The economic position of the aged does not portray a happy picture. Of the 20 million aged in this country, one-fourth are living below the poverty level, and the rest barely have enough income for more than minimal living. In 1971, the aged poor accounted for 20 percent of the total poor population of the United States; the aged poor were only 10 percent of the total population. In 1959, the aged poor were 15 percent of the total poor population. This means that the financial status of the aged has steadily decreased.

Almost all families are covered by social security, but financial security is also determined by income from earnings, private pensions, insurance, savings, unemployment compensations, and/or other assets. The following table gives the percentages of the age population with incomes from different sources.

Table 1 Income Sources of the Aged

24%	**employment**
73%	**social security**
14%	**old-age assistance**
8%	**no cash income**

Source: "Programs for the Aging" JOURNAL OF HOME ECONOMICS, Washington D.C.: American Home Economics Association, Vol. 65, No. 4, April 1973.

The most significant source of income is the retirement program. In 1962, retirement programs constituted two-fifths of the aged's total income; 30 percent of that was social security benefits, 6 percent was railroad retirement and other government program benefits, and 3 percent was private pensions. Earnings were one-third of the retirement income. The rest came from assets and aid from relatives.

The median income for retired couples in 1967 when one person worked was $2,530. If neither was employed, the median income was $2,200. The minimum adequate cost of living for any aged couple was $2,699-$3,200; the moderate standard of living was $4,000, both of which were more than the actual median income. All of these figures have increased since 1967. The incomes earned by the aged in 1958 and 1960 are as follows:

Table 2 Percent of Aged in Different Income Levels

1958	*1960*	*Incomes*
12%	53%	$1,000 & less
24%	24%	1-2,000
18%	10%	2-3,000
44%	13%	3,000 & over

Source: 1958 statistics-Bureau of the Census Report. 1960 statistics-Orbach, Harold, AGING AND THE ECONOMY, Ann Arbor: University of Michigan Press, 1963.

The income position of the aged has been steadily decreasing. Between 1958 and 1960, the percentage of those living on less than $1,000 a year increased 41 percent, and those living on more than $3,000 a year decreased 31 percent.[6] It is interesting to note here that the disposable personal income of the United States in 1958 was $318.8 billion. By 1960, that had *increased* to $350.0 billion.

Marital status has a great affect on retirement income. The median income was $2,900 a year for couples and $2,400 a year for the nonmarried.[7] A 1963 study by the Bureau of Census showed that of the married couples who had no source of income other than OASI, 32% had median incomes of $83 a month, 66 percent had $100 a month, but none had more than $150. The nonmarried retirees with only OASI benefits had much lower incomes; 44 percent had median incomes of $52 a month, 50 percent had less than $50 and 90 percent had less than $75 a month. Widows fared slightly worse than those not married; $43 percent had OASI incomes of $44 a month, 66 percent had less than $50 and none had over $75 a month. Only two percent of the widows had income sources other than OASI.[8]

Age is negatively related to income. Most of this relationship is due to the earning ability of the person which will be discussed later. The drop in income is "the result of a declining ability to work, lower probability of earned pension rights associated with age, and the fact that retirement benefits for the older age group are based on progressively outdated earnings."[9]

Assets also contribute to retirement income. Only one out of five aged units had few or no assets (regarded as less than $1,000). The higher the income, the more assets held. Marital status was significant in the amounts of assets held by couples and by singles. Those people who were not married had slightly more assets to their name, but, in both cases, the amount of assets held increased as the level of income earned increased. Home ownership is considered one of the most important assets an older person can possess. More homes are owned by married couples, but, the majority of retired persons own a mortgage-free home.

The amount any family can save is the difference between the income it receives and the level of basic living

Table 3 Percentage Increase of People Over 65 and 85.

1920 - 1960	**increase of 279 percent of people over 65.**
1920 - 1969	**increase of 920 percent of people over 85.**

Source: Oppenheim, Irene, THE FAMILY AS CONSUMERS, New York: The MacMillan Co. 1965.

Table 4 Population Increase of the Aged in 3 Years.

1967	**17,000,000 people 65 and over.**
1970	**20,000,000 people 65 and over.**

Total increase of 3 million in 3 years.

Source: Buckly, Joseph C. THE RETIREMENT HANDBOOK, New York: Harper and Row Publishers, 1962.

costs. The life cycles usually determine the best years to accumulate savings. In general, between the ages of 40 and 65, the family has become financially secure; therefore, these are the best years to save for retirement. In actuality, most families either do not plan adequately or an emergency or inflation destroys all or part of their savings. In a survey of 15,500 people receiving social security benefits, less than half had cash (up to $500) in the bank, one-third had about $2,000.[10] Another report stated that 70 percent of the aged have less than $5,000 in savings.[11] One point of interest is that 84 percent of the aged have no installment debt either because they refrain from accumulating debts or they are *not* given credit. On one hand, this keeps the aged free from the worry of paying debts, but on the other hand, it prevents them from enjoying some things in the present that they can not afford.

In the past, the population of people 56 and over has increased 3-4000,000 every year, but with improved technology, this rate has rapidly been increasing. A few brief tables will clarify this situation.

The most important statistics to the concept of employment in retirement are found in Table 5.

persons.

Although inflation has recently hit America very hard, the United States has one of the lowest inflationary rates of any major industrial society.[12] The rate in August 1973 reached 22 percent, but the average annual rate of inflation for 1973 was about 8 percent. The predicted rate of inflation given in 1964 was about 1½ percent a year which meant that by 1989 (25 years later) one dollar would be worth 67 cents.[13] At the current rate of inflation, the dollar will be worth much less than 67 cents in 1989. This unexpected rise in the rate of inflation found many people in a financially inadequate position, especially those in their 70's and 80's. With the life expectancy increasing every year (a man's life expectancy is 77 years and a woman's is 79 years), a family would need at least $60,000 for their retirement years at the present cost of living. If a family receives the median retirement income of $2,530 a year, it must be able to produce $30,000 in savings or have another source of income to support them during retirement. The real problem lies in the fact that the rate of inflation can wipe out any savings if it continues in its spiralling fashion. No one knows how much the dollar will be worth in

Table 5 Population Increase Compared to Labor Force.

1950 - 1962	**U.S. population increased 24 percent.**
1962 - 1970	**U.S. population increased 12-15 percent (predicted)**
1970 - 1980	**U.S. population increased 17-21 percent (predicted)**

Total of 32 percent increase.

1962 -	**74,000,000 people available for work.**
1970 -	**84,000,000 people available for work. (predicted)**
1980 -	**99,000,000 people available for work. (predicted)**

Total of 34 percent increase

Source: Orbach, Harold, AGING AND THE ECONOMY, Ann Arbor: University of Michigan Press, 1963.

The United States economy can not handle the increase of labor for the population as a whole; consequently, it can not even hope to absorb the aged population into its labor force. The per capita production would not gain anything if the aged were hired; it would still increase a little less than three percent annually with or without the added labor. Again the marital status influences the decision to work after retirement. Married couples are more frequently employed during their retirement than nonmarried twenty years; no one can tell anyone how much to have for his/her retirement. A plan must account for a high rate of inflation. Many people invest in land or some other resource that is likely to gain in value instead of lose in value like the dollar.

There are many opinions on the success of the social security system and its effectiveness on those in retirement. The point in question is, "Does the social security program fulfill the goals it set out to accomplish?"

It has been found that a majority of retired people are living well below the minimum standard of living. Many experts in the field ascertain that our country could afford to raise the level of living of the elderly without much stress on our economy. While the United States has a national level of output of goods and services equal to $550 billion, it is making payments of only $15 million to the elderly.[14] This means that OASI payments are only two percent of the Gross National Product. Restating the primary aim of the social security program, which is to assure an adequate income to each human being, recalls to mind the simple fact that those people in retirement do *not* have an adequate income. Robert Browning said of old age, "The best is yet to be; the last of life, for which the first was made," How much do *we* have to look forward to?

[1] *Orbach, Harold L. and Tibbits, Clark, AGING AND THE ECONOMY. Ann Arbor: University of Michigan Press, 1963.*

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[6] *Orbach, op. cit.*

[7] *"Resources of People 65 or Over" U.S. Department of Health, Education, and Welfare, Social Security Publication 1-71 (1-71).*

[8] *Ibid.*

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Measuring Natural Beauty:

The problem of quantification

*by Ted Born**

Except within the vaguest limits, beauty cannot be described: therefore it cannot be defined. It cannot be measured either in quantity or quality: therefore it cannot be made into the basis of a science. It has always proved impregnable to the frontal attacks of the aestheticians . . . none the less it would seem reasonable to stalk the word, to outflank it and creep upon it from behind. Eventually one must have the courage to meet it face to face, but a preliminary reconnaissance demands subtlety rather than courage (1).

With this quotation from Eric Newton, Robert Kates reminds us of the difficulty of establishing a satisfactory criterion for beauty *in general.* In response to the difficulty of mounting a "frontal attack" on beauty, he suggests that we "stalk the word" by trying to measure and eliminate ugliness instead. Kates feels that ugliness draws upon a much wider and firmer consensus than does "illusive beauty." He suggests that appropriate tools for measuring ugliness include collective wisdom, limit or boundary analysis, and the perceptions from resource users of "those misfit items in a specific landscape that lead to instant ugliness (1)."

The weaknesses in Kates' approach seem to be in his failure to recognize that "misfitness" is as subjective a concept as that of beauty, and that if collective wisdom is to help us escape the destructive power of ugliness we need only look at the typical American urban scene to question the appropriateness of the use of this particular guideline in the search for aesthetic satisfaction. Resource user perception may also be suspect when one finds that a sample of 1,000 respondents in Vermont indicated that a dead tree was more of an eyesore than a billboard, and that garbage dumps and abandoned old cars were only slightly more objectionable than this *natural product*

**Former Research Associate in Watershed Management Department, U of A; now with Dame & Moore of Denver, Colo.*
University, Fargo, 58102.

Figure 1. Beaver Creek Watershed Number 7, left, Coconino National Forest, Arizona. A ponderosa pine "relict" area. Basal area is a dense 180 square feet per acre. Boster and Daniel, in their scenic value estimator research used a site similar to this as their visual control.

of the environment (2).

The United States Forest Service has not been as reticent in attempting to define beauty. "Any quality of sense or thought that excites an admiring pleasure(4)", seems to be an explanation of the concept of beauty that is worthy of consideration. Eric Newton's idea that natural beauty *in particular* is a "by-product of function" (1) supports the Forest Service's contention that "we can include interest and understanding along with pleasing appearance as important components in the appreciation of beauty and in the application of esthetic principles to the natural landscape (4)." Specific factors which tend to lend beauty to the landscape are harmony (4), contrast (2,4) pattern (2), variety (2,4), large expanses of land with

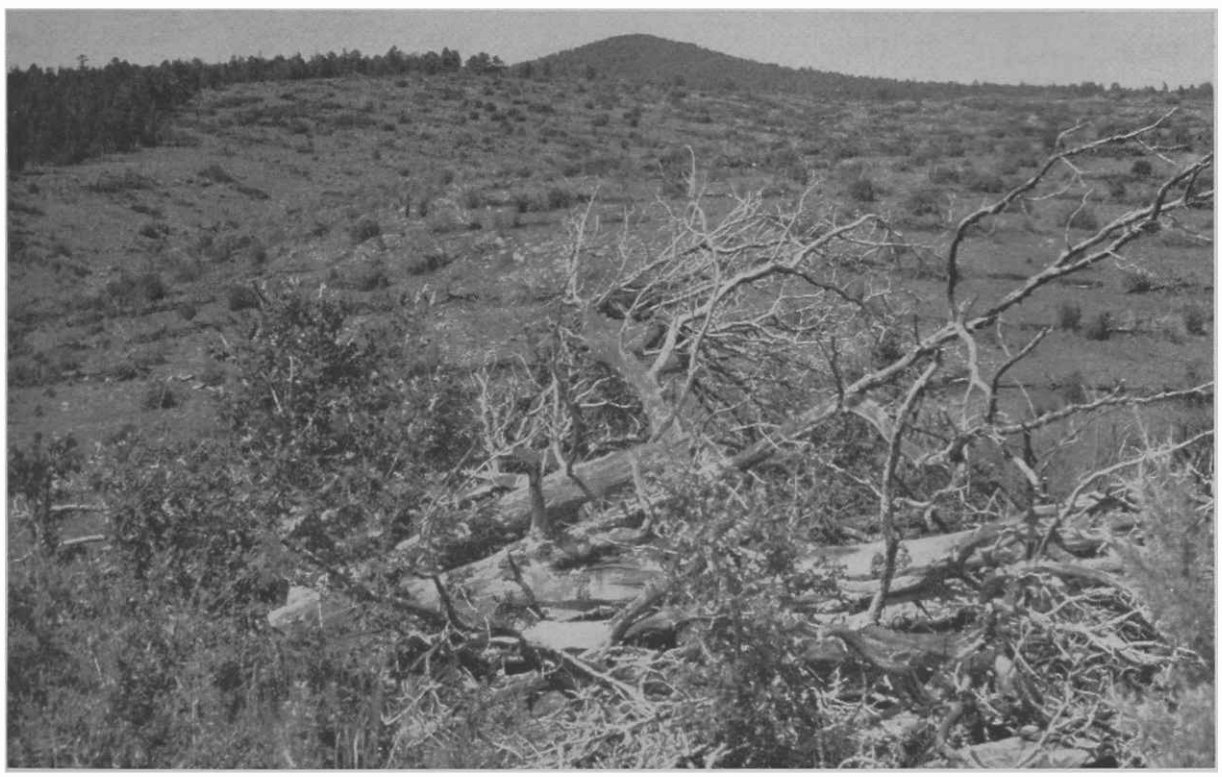

Figure 2. Beaver Creek Watershed Number 12, above, Coconino National Forest, Arizona. Logging here consisted of clear-cutting and the windrowing of slash. Student respondents preferred the control area to this treatment site in Boster and Daniel's research.

the implication of distance (2), and the notion of "functionalness" (1) which seems to be coupled with those of interest and understanding (4). With regard to the last of these factors which tend toward the creation of landscape beauty, Sargent, emphasizes that natural aesthetics "may be enhanced by man's activities" which can "provide contrast and patterns that are interesting" (2).

Attempts to Quantify Scenic Values Shafer's Regression Equation

Kates and Newton not withstanding, a few pioneering individuals are grappling with the problem of measuring and quantifying natural beauty. Shafer and various associates have constructed a regression equation which they suggest accounts for 66% of the variance generated when respondents are asked to rank photos of landscapes according to the attractiveness or degree of "beauty" of each of the scenes. With the use of the equation and values based upon perimeter and area measurements of various visual zones in each photo, Shafer claims to be able to quantify scenic beauty by means of a single numerical score. His work has involved the utilization of photos of different types of natural areas from all over the United States, and of respondents from New York State and Utah.

The obvious criticism of this method is that the beauty being measured is photographic rather than actual. Shafer's response is that photos are legitimate surrogates of the real world, making possible research that would otherwise be prohibitively expensive because of the respondent travel which would be required for on-site experimentation. Shafer does concede that his method may be inappropriate for ranking "micro" and "macro" scenes together on the same scale and that his model may more accurately predict preferences for landscapes that do not contain water (3), but it would appear to this reviewer that there is a much more fundamental difficulty with his approach. Shafer's method seems to assume a static relationship between the viewer of a scene and the scene in question. The unchanging nature of the photographic image symbolizes this assumption. In actuality, the relationship between a viewer and scenery is dynamic. Even when a tourist stops at a designated viewpoint to look at a natural wonder, there are a variety of different scenes that meet his eye as he moves from his car to the overlook and back.

Shafer's equation seems particularly vulnerable to this criticism because the variable in the formula with the largest coefficient is the perimeter of the immediate tree and shrub zone. The implication is that how a particular scene is "framed" is exceedingly important to its "score" for natural beauty. The presence, absence or characteristic of the frame is greatly dependent upon the position of the photographer vis-a-vis the most immediate vegetation, and this relationship usually can be changed if the viewer walks a relatively short distance in any direction. To consider the asquisition or preservation of land, as Shafer has suggested, largely on the basis of such an ephemeral characteristic of environmental perception as that viewed by means of photos, or even from one particular point on the ground seems rather risky, whatever the possible aesthetic merits of the landscape in question.

Scenic Value Estimators

Boster and Daniel[1] can justifiably make claim to greater success than Shafer in the effort to quantitatively measure scenic values. In attempting to evaluate "public response to vegetation management," they have developed a technique based upon the psychologist's theory of signal detection. They selected five forested sites in Arizona representative of five different types of cutting and one "relict" area to serve as a natural control. Using tables of random numbers they photographed each site from a variety of positions and azimuths and then randomly selected twenty-five photos from each area. Student respondents were asked to rate, on a zero-to-nine scale of relative attractiveness, the randomly mixed photos from the sev-

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Figure 3. Beaver Creek Watershed Number 17, above, Coconino National Forest, Arizona. One of Boster and Daniel's sites was this heavily thinned area. Density here has been reduced to about 25 square feet of basal area per acre.

eral treatment sites and the control. From the data so obtained cumulative preference curves were drawn for each treatment, and then by means of basic mathematical techniques the five treated sites were compared with the relict area in order to measure relative preference for each of the treatments against the control.

Analysis of the data indicates that perception of different treatments varied markedly and that, in general, "natural-appearing" areas tended to be preferred. Two of the treated areas, regular stripcut and conventional logging, were preferred over the relict site. An interesting side note was the collective response of the Arizona Water Resources Committee to the vegetation management alternatives represented by the slides. The Committee, unlike the basic student sample, preferred all five manipulated areas over the relict, perhaps testimony to their awareness of and positive attitudes towards intensive natural resource management.

One might offer the criticism once again that what is being measured is photographic rather than natural beauty, but the method of scenic value estimation overcomes Shafer's basic problem through the procedure of presenting respondents with relatively many photographs of the same site. This method emphasizes the fact that it is the site which is the object of evaluation, not one photographic scene, and interjects an element of dynamism that is lacking in Shafer's technique. Even more convincing than this intuitive argument is the remarkable fact that knowing the values established by the original sample through the use of photos enabled the researchers to predict the on-site judgments of a group of summer session students with 98% accuracy.

Two minor criticisms might be offered. One doubts that respondents can actually take into account the descriptive labels associated with each of the nine numerical values on the rating scale during the short exposure time for each slide. In addition, the method may not meet a criterion for relative low cost. One last comment involves a problem critical to all attempts to quantify scenic values, however successful. Even if one can establish a valid reliable quantification technique, how does one relate the unit of measurement so generated to other, more traditional, measures of natural resources such as board-feet, animal units and ultimately, dollars? This question becomes exceedingly important when the natural resource manager must weigh the costs and benefits of alternative vegetation treatments and only one can be selected as the basis for operations. It is not unreasonable to assume that those impacts most easily measured in clear economic terms are likely to receive relatively greater consideration in the decision-making process. Successful quantification of scenic beauty is one important preliminary step along the path to assurance that intangible values will carry appropriate weight in the allocation and management of land and other natural resources.

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