Economic Potentials from Blue Grama Seed Production Under Irrigation in Northwest Oklahoma[1]

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Blue grama is an excellent grass with a very wide range of usefulness. It has been particularly valuable as a component of seed mixtures for reseeding in the central and southern plains. Very few experimental and no commercial attempts have been made to grow blue grama seed under intensive cultivation. Seed used has been harvested from native stands. Seed production under cultivation could be of great benefit in terms of assured quality, supply, and price to blue grama seed users. It would also increase and distribute superior varieties as they become available.

A previous paper (Kneebone 1957) outlined a technique for producing high yields of quality seed under irrigation and intensive management. To have commercial production under cultivation, however, high yields of seed must be not only possible, but also profitable. The present paper evaluates experimental results over a 6-year period in terms of potential profit. It was assumed that seed crops would be grown as part of a diversified crop and livestock enterprise having irrigation facilities.

Sources of Data

Yields and Treatments

The technique developed at Woodward, Oklahoma, for growing blue grama seed requires the following procedures applied to a solid-drilled stand: 1. Keep grass semi-dormant by close mowing or grazing until midsummer. 2. Apply 50 pounds of actual nitrogen per acre in mid-August. 3. Water the nitrogen in and continue irrigation as needed through September. 4. Control injurious insects during flowering period (most effective control of those studied was 4 ounces of dieldrin per acre, sprayed on at late boot stage). These procedures were followed on the same stand of grass in each of the 6 years 1954-1959. A beater-type mower was used in early summer and spraying was done by hand, otherwise treatments were the same as those a commercial grower with a sprinkler irrigation system might use. Records were kept of the actual amounts of water, fertilizer, and dieldrin used each year. All yield data are averages based upon hand-harvested, hand-cleaned seed from at least 4 replications each year. Samples were harvested from 1/1000 acre strips in 1954-1957 and from 3 square yards per plot in 1958-1959. Plots were either 5 x 20 or 8 x 20 feet each year.

Harvested seed was cleaned until judged equivalent to average commercial seed. After weighing, samples were cleaned to caryopses and re-weighed to

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determine caryopsis percentages. Pure seed production per acre was considered equal to caryopsis yield per acre multiplied by 1.63 (Harlan and Ahring 1960). Pure live seed production was calculated on the assumption of 80 percent germination.

Production Costs

Machine operations were those normally expected in establishment or actually applied in production. All except mowing and applying fertilizer were charged at prevailing custom rates (Tucker et al. 1956). For these two operations, the operator would in most cases have his own equipment and provide labor to run it. The custom rates per acre for them were accordingly reduced by a figure representing the estimated time of operation charged at $1.00 per hour. The custom rate for drilling grass seed is that charged by the Woodward County, Oklahoma, Soil Conservation District for tractor, drill, and driver in 1959 and 1960.

Undisturbed sorghum stubble provides a firm seedbed, protected from wind erosion. Drilling in such a seedbed is the recommended method for planting grass in northwest Oklahoma, particularly on the sandier soils. Although some charge for cover establishment might ordinarily be made, cost figures for this study were estimated on the basis of a stubble cover left over from and paid for by a previous cash crop. Agricultural Conservation Program payments for establishing a cover require nonremoval of the crop and, at 1960 levels, would not meet estimated costs.

Estimates of average dealer costs per pound of pure live blue grama seed in each of the years 1954-1959 were provided by Thos. O. Munger, of Johnston Seed Co., Enid, Oklahoma. In estimating establishment costs a heavy seeding rate (2½ pounds of pure live seed per acre) was assumed. Seed costs were assessed at 130 percent of dealer costs averaged over the period of the experiment. All establishment costs were depreciated on the assumption of 10 years' stand life. (The experimental area was seeded in 1950.)

Because systems vary a great deal in efficiency and initial investment, irrigation costs per acre inch can also vary a great deal. Assuming an efficient sprinkler system of fair size (60-80 acres) $.50 per acre inch would be a conservative estimate of annual operating charges in northwest Oklahoma according to local farmers and agricultural advisers. Total irrigation costs including depreciation, interest, taxes, and hired labor would range between $1.75 and $2 per acre inch (Duffin).

Ammonium nitrate fertilizer was used throughout the experiments. Insecticide treatments for which yields are reported were with a dieldrin formulation containing 1.5 pounds of actual dieldrin per gallon. These two products were charged at 1960 levels. Local dealers stated that their prices had been at approximately these levels since the beginning of the experimental period.

Charges for seed handling were estimated from data provided by E. Rowley, District Manager, Woodward County Soil Conservation District, Woodward, Oklahoma, based on several years' experience with native grasses. The charges include labor for scalping, sacking, weighing, and tagging and costs of the sacks and tags. Seed-analysis cost was estimated for a commercial laboratory analysis of the harvest from a 40-acre field.

Returns

Ordinarily, most operators would take advantage of governmental financial help in seeding native grasses. Since governmental programs vary from year to year, the 1960 payment schedule of the Agricultural Conservation Program for Woodward County, Oklahoma, was used. This covered 70 percent of seed cost plus an allowance of $.50 per acre for drilling the seed.

Hay prices for the years of the study were average annual prices of native hay in Oklahoma reported by the Oklahoma Crop and Livestock Reporting Service. Yields were set at 1 ton per acre with half going to the grower, half for harvest by a

Table 1. Estimated first-year costs per acre to establish blue grama for seed production under irrigation northwest Oklahoma

Source of expense	Amount
	Dollars
Grass seed (2½ lbs. PLS at $1.62)	4.05
Drilling (custom basis)	1.25
Mowing twice (custom less operator's time at $1.00 hour)	1.50
Irrigation (Two 2-inch applications at $.50 acre inch)	2.00
Total seeding year costs	8.80
Interest on seeding year costs (6 months 6%)	0.26
Total seeding costs plus interest	9.06
Less 1960 ACP payment for seed (70% cost)	2.84
Less 1960 ACP payment for drilling	0.50
Less grazing rental Nov. 1-July 1	0.90
Net cost	4.82
Interest on average investment (10 years)	1.45
Total establishment costs plus interest	6.27
Annual charge over 10 years	0.63

Table 2. Annual costs per acre to grow blue grama seed under irrigation using recommended practices including insecticide northwest Oklahoma 1954-1959[1]

Item	1954	1955	1956	1957	1958	1959	Average
				(Acre-in.)			
Irrigation applied	9.0	9.0	10.9	5.4	7.2	5.4	7.8
				(Dollars)			
Irrigation cost ($.50 per acre-inch)	4.50	4.50	5.45	2.70	3.60	2.70	3.91
Fertilizer (50 lbs. N per acre at $.129 per lb.)	6.45	6.45	6.45	6.45	6.45	6.45	6.45
Application of fertilizer	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Insecticide (4 oz. dieldrin per acre, 1 or 2 applications)	0.90	0.90	1.80	1.80	1.80	0.90	1.35
Spraying insecticide	2.00	2.00	4.00	4.00	4.00	2.00	3.00
Combining grass seed	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Seed handling ($.0063 per pound)	1.98	2.45	0.46	0.50	1.59	1.26	1.37
Seed analysis	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total production costs	21.13	21.60	23.46	20.75	22.74	18.61	21.38
Interest at 6% for 6 months	0.63	0.65	0.70	0.62	0.68	0.56	0.64
Total production costs plus interest	21.76	22.25	24.16	21.37	23.42	19.17	22.02

[1]Estimated from experimental data.

custom operator. They were based on measured air dry forage after seed harvest in 1954, 1955, and 1959 averaging 2,200 pounds per acre. Grazing value was assumed to be equivalent to half the average annual rental in Woodward County of $1.80 per acre for native range.

Results and Discussion

Establishment costs (Table 1) cover the period from seeding to beginning irrigation for the first seed crop. If the sorghum cover were produced under the 1960 ACP program, an extra $0.21 annual charge per acre would be necessary for establishment costs. By irrigating in late summer of the seeding year, sufficient growth should be obtained from the young stand to begin light grazing in November after the grass becomes dormant. The 9-month period from November to July was credited with half the annual rental value of native range.

Production costs (Table 2) were relatively constant during the 6-year study period. They ranged from $19 to $24 per acre. In some years 2 applications of dieldrin were made. Probably the average grower would spray only once, thus saving nearly $3 per acre. Seed-handling costs would vary according to the efficiency of the labor available and might run somewhat higher for many growers than listed. Total seed-handling costs vary with the size of the crop. Irrigation costs, on the other hand, vary with the year and, as the production data in (Table 3) show, are not necessarily reflected in yield figures. As would be expected, production costs per pound of pure live seed were low in years of high production and high in poor years (Table 4). In every year except the 2 poor years, 1956 and 1957, there was a substantial margin between production cost and market value. Estimated returns per acre from seed (Table 3) varied over a wide range ($12-$191). Variations in both seed yields and prices during this period probably include most of the long-time expected range. If this is true, maximum gross return from seed might be approxi-

Table 3. Annual gross returns per acre from blue grama seed production under irrigation using recommended practices including insecticide northwest Oklahoma[1]

Item	1954	1955	1956	1957	1958	1959	Average
				(Pounds)			
Scalped seed	315	389	73	79	253	199	218
Pure live seed	143	191	20	12	69	33	78
				(Dollars)			
Return to grower per pound PLS	1.00	1.00	0.90	1.00	1.50	2.00	1.23
Gross return from seed	143.00	191.00	18.00	12.00	103.50	66.00	88.92
Estimated owner's share of hay (½ ton)	9.88	8.10	11.21	8.11	6.48	7.19	8.50
Estimated grazing rental (May-July)	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Total gross return from seed, hay, grazing	153.78	200.00	30.11	21.01	110.88	74.09	98.31

[1]Estimated from experimental data.

Table 4. Production costs per pound of pure live blue grama seed grown under irrigation using recommended practices northwest Oklahoma 1954-1959[1]

Practice	1954	1955	1956	1957	1958	1959	Yearly average	Total yield 1954-1959
	(Dollars)							
With insecticide	0.16	0.12	1.25	1.85	0.35	0.61	0.72	0.29
Without insecticide	0.17	0.12	1.12	2.01	0.34	1.01	0.80	0.28

[1]Estimated from experimental data.

mately $400 per acre (200 pounds at $2) and the minimum about $10 (12 pounds at $.90). If seed were of an improved variety grown under a certification, a grower would reasonably expect to get some premium over native harvest prices. Oklahoma certification costs in 1954-1959 would have been approximately $10 per acre per seed crop. In the early increase period for a new variety premiums of a dollar or more per pound might be obtained. Later prices would adjust according to demand and to competition from native harvests.

Forage production should be an important consideration in any grass seed enterprise. This is particularly true with blue grama in northwest Oklahoma, because early-season grazing or mowing appears to be an essential point in producing seed at all. Grazing during the first half of the summer was conservatively credited at one half of the average annual rental for native range (Table 3). A blue grama pasture on the Southern Plains Experimental Range, seeded in 1951 with the same seed as used for this study area, produced an average of 33 pounds of beef per acre during the period May 1-August 15 over the 1954-1959 seasons. Grazing was by yearling Hereford steers on a yearlong basis. Beef production per acre by yearling Hereford steers grazing native range pastures at a moderate rate yearlong was 22 pounds for the May 1-August 15 period and 36 pounds annually on the same experimental range from 1954-1959.[3]

Because of fertilization and irrigation a considerable quantity of high-quality forage was produced with each seed crop. Measured yields after cutting seed in 1954-1955 and 1959 averaged better than a ton per acre. In commercial production, tailings from the combine would also be available. Although seed production varied considerably from to year, forage yields remained at about the same levels. Returns from this forage were credited in Table 3 on the assumption that 1 ton of hay was custom-harvested for half share. Average Oklahoma prices for native hay ranged from $12.97 per ton in 1958 to $22.42 in 1956. Ten-year (1950 to 1959) average hay price was $17.52. Local prices in northwest Oklahoma generally run higher than statewide averages. Many operators would prefer to use the grass on the ground for high-quality winter pasture or harvest all the hay themselves. Data from the Southern Plains Experimental Range indicate that approximately 20 pounds of air dry forage is needed on the ground in the fall for every steer day during winter. This figure includes both the amount of forage used by the steer and amounts needed to cover losses from trampling and other causes.[3] On this basis, the forage remaining on the ground after seed harvest would provide winter grazing for nearly one steer per acre. An astute operator might be able to recover all or more of his operational expenses each year in hay or grazing.

Dieldrin insecticide, necessary for maximum seed production, poses some problems in terms of forage value after seed harvest. The 4 ounce per acre rate and the elapsed time of more than 6 weeks from spraying to forage

Table 5. Annual net returns per acre from blue grama seed production under irrigation using recommended practices including insecticide northwest Oklahoma 1954-1959[1]

Item	1954	1955	1956	1957	1958	1959	Average
	(Dollars)						
Annual establishment cost	0.63	0.63	0.63	0.63	0.63	0.63	0.63
Cost per seed crop	21.76	22.25	24.16	21.37	23.42	19.17	22.02
Total cost per seed crop	22.39	22.88	24.79	22.00	24.05	19.80	22.65
Total estimated gross return from seed, hay, and grazing per seed crop	153.78	200.00	30.11	21.01	110.88	74.09	98.31
Net return per acre to land, equipment investment, labor and management	131.39	177.12	5.32	—0.99	86.83	54.29	75.66

[1]Estimated from experimental data.

[3]*E. H. McIlvain unpublished data.*

Table 6. Annual costs and returns per acre from blue grama seed production under irrigation using recommended practices *except* insecticide northwest Oklahoma 1954-1959[1]

Item	1954	1955	1956	1957	1958	1959	Average
				(Pounds)			
Scalped seed	329	377	76	61	265	225	222
Pure live seed	119	170	17	8	54	17	64
				(Dollars)			
Return to grower per pound PLS	1.00	1.00	0.90	1.00	1.50	2.00	1.23
Gross return from seed	119.00	170.00	15.30	8.00	81.00	34.00	71.22
Return from hay and grazing	10.78	9.00	12.11	9.01	7.38	8.09	9.40
Gross return per acre	129.78	179.00	27.41	17.01	88.38	42.09	80.61
Cost of irrigation, fertilizer, and harvest	15.95	15.95	16.90	14.15	15.05	14.15	15.36
Seed handling cost ($.0063 per lb.)	2.07	2.38	0.48	0.38	1.67	1.42	1.40
Seed analysis cost	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total crop cost	18.32	18.63	17.68	14.83	17.02	15.87	17.06
Interest on total crop cost	0.55	0.56	0.53	0.44	0.51	0.48	0.51
Annual charge for establishment	0.63	0.63	0.63	0.63	0.63	0.63	0.63
Total costs	19.50	19.82	18.84	15.90	18.16	16.98	18.20
Net return per acre to land, equipment investment, labor and management	110.28	159.18	8.57	1.11	70.22	25.11	62.41

[1]Estimated from experimental data.

removal would mean extremely small residues which should not be in any way dangerous to grazing animals. Federal regulations, however, forbid feeding of dieldrin-treated forage to dairy cows or to animals being fed for slaughter. Normal use of the hay or grazing would be for wintering a beef cow herd or stocker steers and would not conflict with regulatory programs. Values given for aftermath forage would be restricted to such normal use.

The importance of the insecticide for seed production is shown by a comparison of net returns in (Table 5) covering data from by a comparison of net returns in (Table 5) covering data from sprayed plots with those in (Table 6) from unsprayed plots. Even though rough seed yields were essentially the same, the pure live-seed production and hence seed value was generally higher on the sprayed plots. Although spraying increased costs, net returns over the 6-year period averaged $13 more per acre when the insecticide was used. Since insect infestations were apparently of little importance in 1956-1957 and control was far from complete in any year, these results are rather striking. An operator seldom gets $13 back from an investment of $4.35 (6-year average spray cost in Table 2).

As pointed out in the earlier paper (Kneebone 1957) nitrogen was essential for seed production. Data from 1954 and 1958 show its importance. In both of these years seed yields were determined from non-fertilized, non-sprayed plots. Production was 22 pounds of pure live seed in 1954 and 33 pounds in 1958, worth $22 and $49.50, respectively. Compare these figures with $119 and $81 in (Table 6) for unsprayed fertilized plots. Since forage yield on the non-fertilized plots was only a few hundred pounds, savings in fertilizer would have been lost in forage.

If 50 pounds of nitrogen does so much good, then how much would more nitrogen do? In 1958, 100 pounds of nitrogen was compared with 50 on unsprayed plots. Fifty additional pounds of nitrogen costing $6.45 produced 5 more pounds of seed worth $7.50. In 1956, 80 pounds of phosphorus applied with the usual nitrogen treatment increased pure live seed yield by 8 pounds, worth $7.20. At 1960 prices the additional phosphorus would have cost $7.40. No forage yields were taken in 1956 or 1958, but all fertilized plots appeared to have similar production. Judging by these results, more than 50 pounds of nitrogen per acre would not be justified.

All the data in (Tables 1-6) are concerned with production and with annual operating costs. They do not consider fixed costs for land, fences, and irrigation. Land suitable for such an enterprise would probably be valued at $100 per acre, while irrigation system, fences and stock-watering arrangements would probably mean additional capital investment of $100 per acre. On the same 10-year basis as the stand of grass, payments on principal plus 6 percent interest would be $25 an acre.

Potential profits averaging $50 per acre over and above all costs (average net return in Table 5 less fixed cost) compare very favorably with those in areas specializing in seed production

(Hyer, et al. 1950). They indicate that more attention should be paid in northwest Oklahoma and the Southern Great Plains to seed production of blue grama and other native grasses.

Conclusions

Blue grama seed production under irrigation could be highly profitable to a diversified crop and livestock operation in northwest Oklahoma. Efficient use of the forage produced would tend to pay most of the production costs, leaving the seed as a cash crop. Since irrigation farmers in the area have been shifting from cash grain crops to marketing of irrigated produce through livestock, this crop would fit in particularly well.

Even though use of dieldrin insecticide would mean added production costs and impose some limitations on use of forage remaining after seed harvest, increased seed sets obtained would give appreciable extra net returns per acre when seed is sold on a quality basis.

Summary

Estimates of net dollar returns per acre were made using blue grama seed and forage production data obtained during the years 1954-1959 from an experimental field at Woodward, Oklahoma.

Forage value estimated in terms of grazing rental and off-farm sale of hay made an appreciable contribution to gross returns. An operator utilizing all the forage produced would probably be able to pay his annual operating costs from forage alone.

Estimated net returns per acre to land, labor, management, and capital from seed and forage over the 6-year period ranged from a net loss of $1 to a profit of $131. Average net return was $76.

Where all recommendations except insect control were followed, the range was from $1 to $110 profit with an average return of $62.

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