SODIUM SEALED MICROWATERSHEDS AND SKIP-ROWING FOR WATER HARVESTING AND CROPPING ON LIMITED RAINFALL

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ABSTRACT

A microwatershed system was established in an area with 250 mm of growing season (June-September) average rainfall. Two growing beds, each 1 m wide, received the runoff from 3 m of adjacent sodium (NaCl) treated watersheds. Six levels of salt from 1.67 to 10 m tons/ha were used on the sheds with grain sorghum grown on the beds. The six years involved two very dry years, two wet years, and two average years. Grain sorghum yields ranged from 1980 to 8650 on the beds with an average of 6200 kg/ha, indicating economic feasibility. Salt levels had no visible effect on the plants and the lowest rate was still effective, both in shedding water and in controlling weeds. A number of other crops were tried on the salt beds over the six years with cotton, sunflowers, soybeans, and sweet sorghum the most successful. A skip-row system (2 in, 1 out on 1 m beds) was compared to 1 m and 2 m rows over 1983-1985. The skiprow system was superior in the dry and near normal years while the 1 m spacing was better in the very wet years. It was concluded that the skip-row system was superior under the local 250 mm growing season rainfall while the salt bed system would be superior in drier areas (100 to 200 mm).

Key words: grain sorghum, soybeans, drought evasion, semiarid crop production, salt treated sheds, dry farming, antitranspirants, runoff farming

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JUSTIFICATION OF WORK PERFORMED

Much of the southern Great Plains area from Nebraska to Texas depends on pumping irrigation water from the Ogallala Formation. This is essentially a mining operation with very little recharge and the available water is being rapidly depleted. Areas on the fringes of the formation are already going out of irrigation because of the falling water table. Some irrigation is being abandoned because of the increasingly high cost of energy needed to pump from depths of 120 to 150 m. Dryland farming in the area is marginal, using conventional methods, due to low and erratic rainfall.

Work in eastern Colorado (Aase et al. 1968) indicates that concrete slabs arranged to shed rainwater onto a narrow growing bed resulted in corn yields over 4400 kg/ha, far above dryland yields in the area. Work in Texas (Mulkey 1968) indicated that sheets of plastic between wide rows increased yields of cotton by concentrating water near the plants. However, the cost of concrete and plastic rules out their use for most agricultural crops. Systems of large-scale water accumulation on level terraces have had only limited acceptance in the Great Plains area (Cox 1968, Hauser 1968, Mickelson 1968), mostly because the cost of earth moving was not economical. More recently, small-scale level terraces (5 m wide) have shown promise because only moderate earth moving is required (Jones 1981). Fuehring (1975) obtained grain sorghum yields approaching irrigated yields on the growing beds adjacent to bare compacted watersheds. However, it was concluded that the cost of maintaining the shed area was prohibitive. More recent work at Clovis (Fuehring 1981) with grain sorghum grown in 3 m by 6 m basins resulted in yields above 3300 kg/ha per year over a three-year period, indicating commercially acceptable yield potential in the area if a workable system can be developed. Finkner and Malm (1971), working at Clovis over a three-year period, obtained average grain sorghum yields of 5200 kg/ha when irrigated at planting time only. The average May-September rainfall for the period was 30 cm, slightly above normal. This again indicates the extra yield potential with very limited additional water.

Work in Arizona (Dutt and McCreary 1974) with salt treated watersheds has been successful in producing grapes and apples. Plants were grown only 60 cm away from the salted area without damage. The salt treated surface area develops a sodium saturated cation exchange complex on the surface soil, effectively sealing it from water penetration. They have also used salt to seal water storage ponds. A telephone call (1980) to the Arizona workers indicated that an 11 tons/ha salt treatment was still effective after eight years. Fink and Erhler (1983) were successful in growing Christmas trees in Arizona, using runoff farming techniques.

The multiplying effect of increased water on grain sorghum yield is based on the theory that the first 143 mm is needed just to establish the plant (Stewart et al. 1983) and then each additional mm of available water will produce 15.4 kg of grain per ha. Thus, the normal seasonal 250 mm of rain (assuming no runoff) could produce 1648 kg/ha ((250-143) x 15.4 = 1648). However, if the 250 mm from 2.5 ha could be concentrated on 1 ha, the theoretical yield would be 7423 kg per ha ((625-143) x 15.4) or 2969 kg per ha for the whole area, thus, almost doubling the total yield and halving the area actually farmed (the other half of the area is in permanent shed, requiring little maintenance).

The salt sealed watershed method holds considerable promise in dryer areas (down to 100 to 150 mm growing season rainfall) by increasing the proportion of shed area as average rainfall decreases.

Skipping a row is another method of water harvesting, provided the water is not allowed to run off. The rows on either side benefit from the extra water, most of which goes directly for grain production. Because it takes a certain amount of water just to produce the plant up to the seed producing stage, any extra water can go to grain. Dryland cotton has been produced by this method in the southern Texas Panhandle for years. In theory, skipping one row in three results in 50 percent more water for the adjacent rows which, under limited rainfall conditions, could easily double grain production in the row. This doubling is equal to one-third more yield for the entire area including the skip-row. Under severe drought, a fully planted crop might produce no grain at all while the skip-row crop produces a substantial amount of yield.

Folicote, an antitranspirant, has been found to increase yields of limited irrigation corn by 15 percent (Fuehring 1983). However, grain sorghum is naturally more drought resistant and responded considerably less. The response to antitranspirants under dryland conditions needs further study on grain sorghum and soybeans.

The objectives of this experiment were to:

1. Develop a system of water concentration whereby the normal rainfall would be sufficient for dependable dryland cropping (average annual rainfall of 400 mm), even in years of relatively low rainfall;
2. Determine the effectiveness of sodium chloride as a soil sealer and sterilant for promoting small-scale water harvesting;

3. Determine the relationship between rates of application and the effectiveness and durability of the salt treatment;
4. Determine whether the salt treated land can be reclaimed by deep tillage;
5. Determine the response of various crops to increased water (from shedding) over various annual rainfall patterns;
6. Determine the effect of skip-rowing as a water harvesting tool on dryland grain sorghum and soybeans along with N application and seeding rate as variables;
7. Determine grain sorghum hybrids and soybean varieties most suitable under dryland water harvesting conditions; and
8. Determine the effect of an antitranspirant, Folicote, and a growth regulator, triacontanol, on the yield of dryland grain sorghum and soybeans.

METHODOLOGY

Procedures: 1. Established a system of alternate low sealed ridges (3 m wide, 13 cm high) and growing beds (2 m wide) on the contour such that water would be shed from the ridges onto the adjacent growing beds, thus, approximately doubling the water for the growing crop. The ridges were sealed by mixing salt (2.5 m wide) into the upper 3 cm and compacting while damp. The salt inhibits weed growth on the ridges. The growing area consisted of two 1 m beds (one row of crop down the center of each) separated by three furrows. The individual plots were 7.5 m long with each plot serving as a closed basin, holding all the rainwater received. The above proportions are such that tractors and combines can travel on the ridges (up off the growing beds) and two sets of growing areas can be farmed with each pass through the field, thus, allowing reasonably large-scale farming methods. The soil was a Pullman silty clay loam (fine, mixed, thermic Torrertic Paleustoll). The sheds were left undisturbed in hopes that they will last indefinitely (at least 10 years?). The growing bed areas were essentially no-tilled, using only a grain drill to apply nitrogen, a sprayer to apply herbicide, and a planter for planting.

2, 3. Six levels of salt (1.67, 3.33, 5.0, 6.67, 8.33, 10.0 m ton/ha) were applied on the ridges (4 randomized blocks). Previous work (Fuehring 1975) indicated that bare, unsalted shed areas were not practical due to the maintenance required to control weeds. Therefore, a zero rate was omitted. Grain sorghum was grown as the test crop on the growing beds. Propazine was sprayed as a herbicide on the nonsalted area (2.5 m wide). Planting rates and fertilizer levels were geared to maximizing grain yields, assuming that 500 to 600 mm of water will be available to the actual crop growing area.

4. Some salt treated ridges (4 levels, 3 replications) were plowed 300 mm deep in order to mix the salt throughout the top soil layer and reclaim the area. Wheat was planted in the fall, 1980, and grain yields of the salted areas compared to the nonsalted check.
5. Various crops, sweet sorghum, sunflowers, corn, Jerusalem artichokes, pinto beans, chickpeas, sugar beets, soybeans, cotton, crambe, and kochia (4 randomized blocks), were grown on the system. One salt level, 6.67 m ton/ha, was used for this phase of the study. Each crop was planted and fertilized at the appropriate time and rate. The yield of each crop was determined.
6. A randomized block field study with four replications and two splits was used on dryland grain sorghum. The first treatment was five nitrogen levels (0 to 56 kg/ha) adjusted for estimated carry-over, if following a dry year. The first split was for three row spacings (1 m, 2 m, and 2 in and 1 out). The second split was for three seeding rates (6.6 to 26.3 seeds/m of row).

7. Single vs double rows on 2 m centers were tried, using five replications and five spacings on grain sorghum and soybeans. Spacings were 0, 25, 35, 45, and 55 cm between rows.
8. Three double row spacings were tried, using the 2 in, 1 out row system on 1 m centers. Spacings were 60, 80, and 100 cm between the two in rows. Five replications were used on each of grain sorghum and soybeans as crops.
9. Ten grain sorghum hybrids and four soybean varieties were tested on the 2 in, 1 out row spacing system, using five replications each.
10. Triacontanol, a growth regulator, was tried on grain sorghum and soybeans grown on the 2 in, 1 out row spacing system. Five replications and eight rates were used on each crop.
11. Folicote, an antitranspirant, was applied on grain sorghum and soybeans grown on the 2 in, 1 out row spacing system. Five replications and five rates were used on each crop.

RESULTS AND DISCUSSION

Yields of grain sorghum (table 1) on the growing beds between sodium sealed microwatersheds were very good during the wet and near normal rainfall years, approaching the yields of a fully irrigated crop. Even during the two extremely dry years, yields were substantial, indicating economic feasibility of the method. Also, the yields for the very dry years indicate feasibility, using increased proportion of shed to growing bed, of the method in areas with considerably lower average growing season rainfall. The rainfalls given in table 1 represent only part of the plant available moisture since about 40 percent of the rainfall occurs during the off season. Part evaporates but the rest is stored in the profile. This extra stored water probably more than compensates for the water that is lost from the shed areas by evaporation. Moisture storage may partially explain why yields during the three driest years are higher than the theoretical yields expected. Preliminary results of an adjacent study with grain sorghum in 1983, 1984, and 1985 indicated that comparable yields can be obtained by conventional planting methods, using skip-row techniques. More work is needed for this comparison, involving more nearly normal rainfall. In wet years, the salt bed system wasted part of the water and yields for the overall area were lower than with conventional planting. Because the sorghum crop can use only about 700 mm of water, any excess becomes surplus. Therefore, it appears that the salt bed system should be used in areas dryer than this location (100 to 200 mm average June-September rainfall). The proportion of watershed should be increased until the growing bed gets about 500 mm of water.

The levels of salt on the sheds had no apparent visible effects on the plants, indicating very little damage from the salt. Also, yields of grain

Table 1

Yield of grain sorghum grown on beds receiving water from adjacent salt treated watershed areas, 1980-85

Year	1980	1981	1982	1983	1984	1985	Average
	-----------------kg/ha for bed + shed area*-----------------						
Salt on sheds m tons/ha							
1.67	800	3160	3190	1460	3450	3030	2520
3.33	790	3150	3760	1230	3430	2680	2510
5.00	780	2870	3540	1190	2980	2940	2380
6.67	730	3350	3020	1350	3740	2820	2500
8.33	830	3270	3330	1300	3640	3100	2580
10.00	820	3010	2920	1210	3500	2960	2400
Average	790	3140	3290	1290	3460	2920	2480
Expected from theory	721	3431	2556	505	3431	3416	2343
CV	18.1%	11.2%	14.8%	13.7%	9.5%	9.3%	
$LSD_{0.05}$	220	530	740	270	490	410	
June-September rainfall, mm (33 yr avg = 247 mm)	104	506	223	90	316	279	253
June	3.0	63.2	52.4	47.2	113.4	69.4	
July	2.5	128.2	107.7	18.8	61.5	48.7	
August	50.1	253.7	41.0	12.4	136.8	37.5	
September	48.2	60.8	21.5	11.6	4.0	123.5	
Nitrogen applied on beds, kg/ha	56	0	134	134	78	134	
Planting date	6-3	6-3	6-4	6-15	5-25	5-29	
Hybrid	DeKalb DK59	DeKalb DK59	GroAgri GSA1212	GroAgri GSA1212	GroAgri GSA1212	GroAgri GSA1212	

*Multiply yields by 2.5 to obtain yields for growing bed areas only sorghum grown adjacent to the high rates of salt application differ very little from those next to the low rates, indicating no trend in grain yield with increasing rates of salt on the sheds. Further work is needed to see how durable the salt treatments are and also the effects of more normal rainfall seasons (three out of six years to date were extreme). Water sometimes tended to stand in the furrows next to the growing beds during the second season, probably indicating some degree of sealing from salt moving off the shed. Tearing up the furrows with a ripper plow eliminated the problem in the following years.

In order to put the economic feasibility of the salt bed system into perspective with irrigation under local conditions, the following analysis was made. The cost (rough estimate) of the extra runoff water under east central New Mexico conditions, using the following assumptions, was:

Local 1985 sale price of dryland: $625/ha

Estimated cost of bulk salt, hauling and application, land shaping, salt incorporation, and compaction: $100/ha

Estimated application rate to last 10 years: 3 m ton/ha

Average annual rainfall: 40 cm

Estimated average annual runoff captured: 25 cm

Cost of salting depreciation at 10 years: $10/year

Average salt investment, $50 at 12%: $6/year

Rent on land at 10%: $62.50/year

Total cost for 25 ha cm runoff: $78.50/year

Cost per ha cm (acre-inch): $3.14

If one extra ha cm of water at $3.14 will produce 154 kg of grain sorghum (Stewart et al. 1983) worth $14.25 (local December 1985 price), the system is economically feasible. The $3.14 water cost compares to local 1985 energy pumping costs of up to $10 per ha cm when pumping from depths of 120 to 150 m. This cost does not include the costs of pumps and distribution of the water. With the salt bed system, water distribution is automatic and free of cost. However, there is no control of the time and amount of water application. Thus, local irrigation costs are becoming prohibitive for low value crops such as grain sorghum and wheat.

In dryer areas, less water would be obtained per unit of salted area but land costs would be less, resulting in about the same cost per ha cm. Keeping the length of slope short prevents water erosion. For large-scale use, the system should be laid out on the contour or across the slope and the furrows diked in order to hold all the water on the land.

Yields of other crops (table 2) have been more erratic with sweet sorghum, sunflowers, and kochia (a forage crop) being most consistent. Cotton had a very good yield in extremely dry 1983 and this crop would probably be excellent for areas with somewhat longer growing seasons than the Clovis area. Soybeans have been handicapped in small plots due to grazing by rabbits. In 1983, 1984, and 1985, this problem was prevented by fencing and very good results were obtained. Corn is less drought tolerant than the sorghums and does not pollenate well in small plots so probably would do considerably better in large fields. Pinto beans are a specialty crop and prices fluctuate violently from year to year. In 1983, they failed to set seed. In wet 1984, the yields of sunflowers, soybeans, chickpeas, and pinto beans were all about the same and their comparative economic feasibility would depend on relative market prices.

Farmers contemplating the salt sealing of watersheds are very concerned that the salt would ruin the land forever. However, the rates used are not

Table 2

Yields of various crops grown on beds receiving water from adjacent shed areas, 1980-85

Year	1980	1981	1982	1983	1984	1985
	------------kg/ha for bed + shed area------------					
Crop						
Corn, grain	failed	1060	1160	530	2120	1710
Sweet sorghum, sugar	620	2620	3080	1040	4670	3810
Sugar beets, sugar	680	failed				
J. artichokes, sugar			1830	820	527	450
Crambe, grain	failed	550	230	80		
Pinto beans, grain	180	980	540	failed	1150	340
Soybeans, grain	failed	1250	rabbits	540	1160	1000
Sunflowers, grain	320	1290	610	370	1130	850
Cotton, lint	150	failed	230	210	321	670
Kochia, forage dry matter	8590	8150	5650	5720	11530	7740
Chickpeas, grain					1130	60
June-September rainfall, mm (33 yr avg = 247 mm)	104	506	223	90	316	279

very large compared to the entire soil volume. The salt works here because it is concentrated in a thin layer. However, if dispersed throughout the soil, the amounts would have little effect. A study was made to see if deep plowing would eliminate the salt effect. Wheat yields (table 3) tended to vary considerably but were not significantly different from the check. Although not conclusive, the one year's data indicated the salt effect was relatively small after deep plowing.

Table 3

Effect of deep plowing of sodium sealed microwatershed system on yield of subsequent wheat crop

Salt on Sheds m tons/ha	Yield of Wheat kg/ha
Check	1740
3.33	1440
5.00	1960
6.67	1100
8.33	1460
Average	1540
CV	70.9%
$LSD_{0.05}$	3060

A 1 m row spacing of grain sorghum was tested against a 2 in, 1 out row system and a 2 m row spacing over 1983 (dry at 36 percent of the average 247 mm June-September rainfall), 1984 (wet at 128 percent of average), and 1985 (near normal at 113 percent of average), (tables 4-6). The two drier years resulted in 29 percent greater yield of the 2 in, 1 out system over the 1 m check. In the wet year of 1984, however, the check was 13 percent higher in yield. The 2 m spacing tended to result in yields below the check yields. The effect of three seeding rates from 64,000 to 128,000 seeds per ha was negligible throughout. The effect of applied N was small, even in the fourth year of continuous cropping to grain sorghum although the first increment, 12 kg/ha average, resulted in a 17 percent yield increase. As expected from theory, the skip-row was better in the drier year while the 1 m spacing excelled in a very wet year.

When the row spacing within the 2 in, 1 out system was varied from 60 to 100 cm (table 7), grain sorghum performed best at 100 cm while soybeans excelled at 80 cm. When the grain sorghum was planted on a 2 m row spacing, double rows were better in yield than single rows. Double soybean rows tended to be better but not significantly.

Hybrid grain sorghum yield trials were conducted during 1984 and 1985 (table 8) with variable results. GroAgri GSA1212 is a good medium season hybrid over both years although several others do not differ significantly from it in yield.

Soybean variety trials were conducted during 1984 and 1985 (table 9) with the experimental 76-411 variety resulting in the greater yield. Crawford was the best of the released varieties.

Neither Folicote, an antitranspirant (table 10), nor triacontanol, a growth regulator (table 11), had a significant effect on grain yield of grain sorghum or soybeans.

Table 4

Grain yield of skip-row vs all-rows planted (continuous dry-land grain sorghum) as affected by seeding rate and nitrogen application, NMSU Agricultural Science Center at Clovis, 1983

N	Seeding Rate, seeds/ha				Overall
	64,000	96,000	128,000	Average	Average
kg/ha	grain yield, kg/ha				
Skip-row (2 m)					
0	307	487	352	382	
14	522	507	572	534	
28	590	527	456	524	
42	582	449	477	503	
56	462	682	385	509	
Average	493	531	448	490***	
Skip-row (2 in, 1 out)					
0	392	639	434	488	
14	499	630	652	593	
28	451	623	596	556	
42	539	881	844	755	
56	445	563	700	569	
Average	465	667	645	592***	
All-rows planted (1 m)					
0	348	368	296	337	403**
14	420	446	471	446	524**
28	446	353	344	381	487**
42	425	327	537	430	562**
56	505	412	421	446	508**
Average	429	381	414	408***	
Overall average	462*	526*	503*		497

*$LSD_{.05}$ for overall seeding rates = 55 kg/ha

**$LSD_{.05}$ for overall N levels = 164 kg/ha

***$LSD_{.05}$ for overall row spacing = 81 kg/ha

Table 5

Grain yield of skip-row vs all-rows planted (continuous dryland grain sorghum) as affected by seeding rate and nitrogen application, NMSU Agricultural Science Center at Clovis, 1984

N	Seeding Rate, seeds/ha				Overall
	64,000	96,000	128,000	Average	Average
kg/ha	-------------------grain yield, kg/ha----------------------				
Skip-row (2 m)					
0	4900	4610	4590	4700	
6.7	4940	5000	4460	4800	
13.4	4900	5340	4870	5040	
20.1	5340	4480	3850	4560	
26.9	5240	4480	5250	4990	
Average	5060	4780	4600	4810**	
Skip-row (2 in, 1 out)					
0	4980	5020	4740	4920	
6.7	5920	5560	5520	5680	
13.4	6140	5830	5980	5980	
20.1	6100	5780	6000	5960	
26.9	6350	6100	5710	6060	
Average	5900	5650	5590	5710***	
All-rows planted (1 m)					
0	6060	5990	5820	5960	5200**
6.7	7370	7260	6380	7000	5820**
13.4	6010	6820	6510	6450	5820**
20.1	6360	6920	6270	6520	5680**
26.9	6620	6530	7230	6800	5950**
Average	6480	6710	6440	6540***	
Overall average	5810*	5710*	5540*		5690

*$LSD_{.05}$ for overall seeding rate = 200 kg/ha

**$LSD_{.05}$ for overall N levels = 400 kg/ha

***$LSD_{.05}$ for overall row spacing = 390 kg/ha

Table 6

Grain yield of skip-row vs all-rows planted (continuous dry-land grain sorghum) as affected by seeding rate and nitrogen application, NMSU Agricultural Science Center at Clovis, 1985

N	Seeding Rate, seeds/ha				Overall
	64,000	96,000	128,000	Average	Average
kg/ha	grain yield, kg/ha				
Skip-row (2 m)					
0	2000	2140	1660	1940	
14	2060	1880	1950	1960	
28	1960	1930	1650	1840	
42	1980	1960	1850	1930	
56	1980	1410	1950	1780	
Average	2000	1860	1810	1880***	
Skip-row (2 in, 1 out)					
0	1880	2110	2120	2040	
14	2680	2170	2050	2290	
28	2140	2440	2460	2350	
42	2120	2230	2540	2290	
56	2360	1920	2210	2160	
Average	2240	2170	2270	2220***	
All-rows planted (1 m)					
0	1990	1560	1950	1830	1940**
14	2120	2050	1900	2030	2090**
28	1750	2090	2540	2130	2110**
42	1600	2040	1850	1830	2020**
56	2130	1740	1880	1910	1960**
Average	1920	1890	2020	1950***	
Overall average	2040*	1970*	2040*		2020

*$LSD_{.05}$ for overall seeding rate = 190 kg/ha

**$LSD_{.05}$ for overall N levels = 580 kg/ha

***$LSD_{.05}$ for overall row spacing = 200 kg/ha

Table 7

Effect of row spacing on grain yield of grain sorghum and soybeans grown under dryland, skip-row, furrow diked conditions, NMSU Agricultural Science Center at Clovis, 1984, 1985

Crop	Two In, One Out on 1 Meter Beds			Double Rows on 2 Meter Centers		
	Distance between rows	Yield 1984	Yield 1985	Distance between rows	Yield 1984	Yield 1985
	cm	----kg/ha----		cm	----kg/ha----	
Grain Sorghum	60	5980	3670	0	5980	2690
	80	6610	3740	25	7580	3550
	100	7050	4000	35	7450	3350
				45	6610	4270
				55	4860	4720
	Average	6550	3810	Average	6490	3720
	$LSD_{.05}$	550	800	$LSD_{.05}$	640	850
	CV	7.2%	14.3%	CV	8.9%	17.1%
Soybeans	60	1710	550	0	2410	990
	80	2070	730	25	2520	1090
	100	2020	600	35	2930	1080
				45	2520	1140
				55	2610	1050
	Average	1940	630	Average	2600	1060
	$LSD_{.05}$	430	220	$LSD_{.05}$	680	220
	CV	18.7%	24.9%	CV	23.7%	15.2%

Table 8

Grain yield of grain sorghum grown under dryland, skip-row (2 in, 1 out), and furrow diking, NMSU Agricultural Science Center at Clovis, 1984, 1985

Hybrid	Science Center, 1984	Farmer's Field, 1984	Science Center, 1985
	kg/ha		
ORO G EXTRA	7050	3690	3090
NK 2779	6550	3000	2900
TT Two 64yG	6510	2460	3210
TE Y101-G	6860	2630	3140
Jacques 505	6340	2880	3560
GROAGRI GSA1212	7500	2630	3650
Asgrow Opal	7040	2600	3770
RA 787	7050	2650	2760
DeKalb DK-42y	6370	2790	3450
Pioneer 8493	6870	2240	3540
Average	6820	2750	3300
$LSD_{.05}$	870	510	680
CV	12.0%	17.6%	16.1%

Table 9

Effect of soybean varieties on grain yield when grown under dryland, skip-row, furrow diked conditions, NMSU Agricultural Science Center at Clovis, 1984, 1985

Variety	Grain Yield 1984	Grain Yield 1985
	----------kg/ha----------	
Crawford	2270	1060
Douglas	2260	850
Stevens	1990	590
76-411	2460	1500
Average	2250	1000
$LSD_{.05}$	490	190
CV	19.4%	13.9%

Table 10

Effect of the growth regulator, triacontanol, on grain yield of grain sorghum and soybeans grown under dryland, skip-row, furrow diked conditions, NMSU Agricultural Science Center at Clovis, 1984, 1985

Triacontanol	Grain Sorghum 1984	Grain Sorghum 1985	Soybeans 1984	Soybeans 1985
mg/ha	--------------------	kg/ha	--------------------	
0	7300	3850	2070	770
5	6930	3090	2270	570
10	7290	3520	2140	860
15	7410	4080	2280	670
20	6930	3850	2150	870
25	7491	3650	2270	710
30	7390	3300	2190	840
35	6035	3490	2170	640
Average	7100	3600	2190	740
$LSD_{.05}$	830	1090	480	260
CV	10.8%	23.3%	20.4%	26.8%

Table 11

Effect of the antitranspirant, Folicote, on grain yield of grain sorghum and soybeans grown under dryland, skip-row, furrow diked conditions, NMSU Agricultural Science Center at Clovis, 1984, 1985

Folicote	Grain Sorghum		Soybeans	
	1984	1985	1984	1985
l/ha	kg/ha			
0	6620	3970	2280	660
1.3	6830	4310	2410	710
2.6	6790	4100	2260	780
3.9	6560	3960	2440	760
5.2	6140	3760	2430	780
Average	6580	4020	2360	720
$LSD_{.05}$	1240	840	480	240
CV	17.0%	16.6%	18.5%	25.2%

SUMMARY AND CONCLUSIONS

Grain sorghum and several other crops have considerable economic potential when supplied additional water from sodium sealed microwatersheds. The good performance in two extremely dry years indicates the potential of the system in considerably drier climates, using a greater proportion of shed-to-bed. Further experimental work needs to be done under these drier conditions, using more proportion of shed area. Areas with 100 to 200 mm of June-September rainfall could produce economic crops by using the appropriate proportion of watershed area.

The salt effect on a following wheat crop was relatively small after a deep plowing.

In the original row spacing study, the 2 in, 1 out system is superior to the 2 m single row spacing. However, double rows on the two m spacing had considerable yield advantage over single rows, and this aspect needs further work in comparing the 2 m spacing vs the 2 in and 1 out 1 m spacing.

Seeding rate had very little effect on grain sorghum yields. When nitrogen was a variable, only the first increment (7 to 14 kg N per ha) resulted in appreciable yield increase even in the fourth year of continuous grain sorghum cropping.

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