1984

South Dakota Oat Production Yield and Land Use Trends 1961-1982

Douglas Malo

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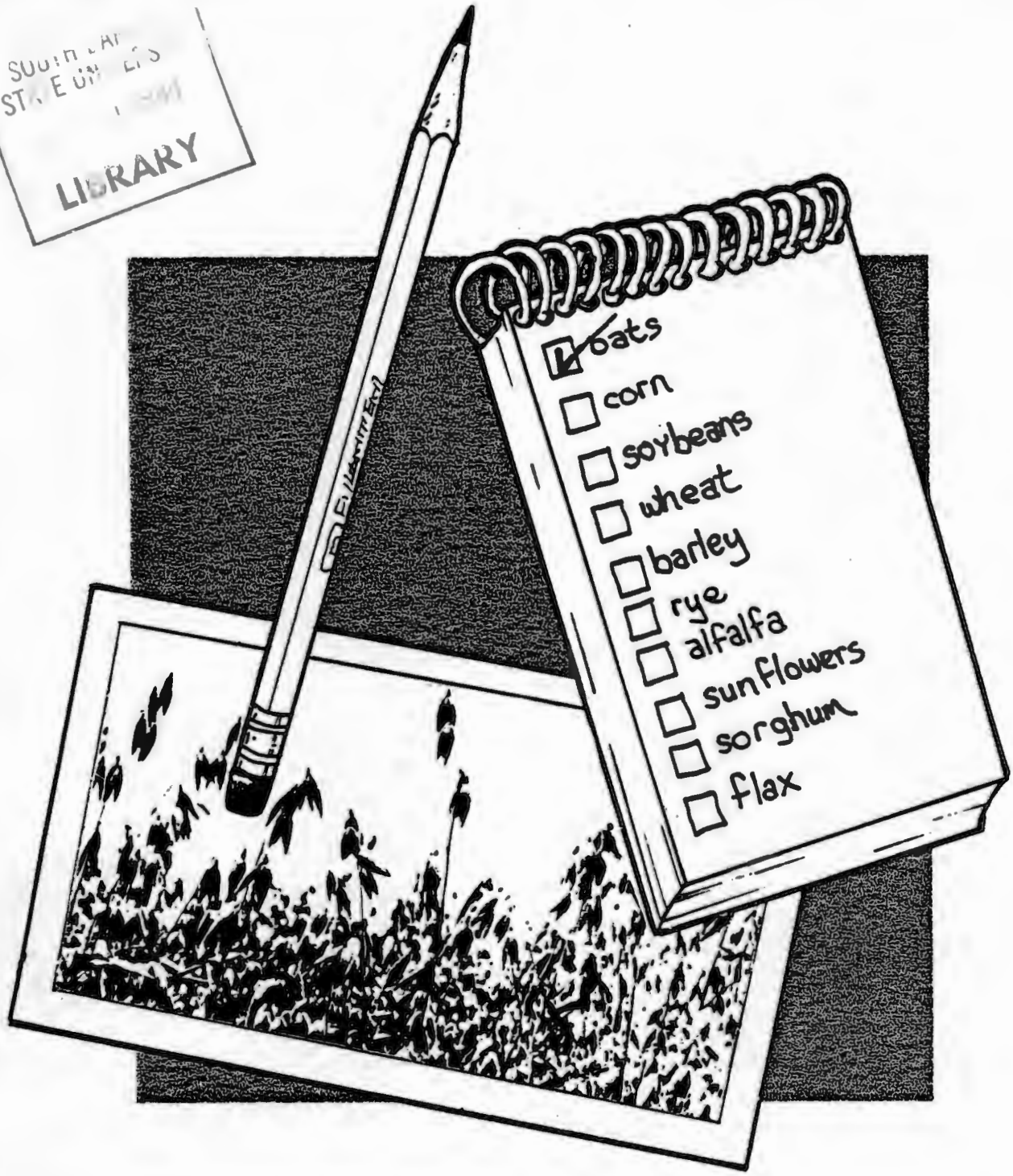
South Dakota Oat Production

Yield and Land Use Trends 1961-1982



Agricultural Experiment Station • South Dakota State University • Brookings, South Dakota 57007

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Acknowledgement

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South Dakota Oat Production[1]

Yield and Land Use Trends 1961-1982

by

Douglas D. Malo[2]

INTRODUCTION

Oats were introduced into the United States in 1602 when colonists brought the crop to Massachusetts to help support the growing livestock population in the colonies. Since that time oats have been a major crop in the United States and North America. The oats crop is used primarily in livestock production and ranks fifth in the world in production after wheat, rice, corn, and barley.

In South Dakota about 2.6 million acres is seeded to oats each year. This represents about 13% of the land suitable for cultivation or 5.3% of the total state land area. Oats are raised in every county of the state. In the last 5 years South Dakota has ranked either first or second in the nation in total oat production. (Statistical Reporting Service, 1979 to 1983).

Since 1940 major changes in management practices (including fertilization, new varieties, herbicides, new crops, increased yields of other crops, fewer general farms, and more mechanization) and climatic shifts have caused significant changes in the yield, market demand, method of harvesting, and the acreage planted for oats. As a result, a study was initiated to identify changes in yield, land use, and total oat production by county in South Dakota.

The objectives were to:

1) prepare and develop a data base of county oat acreage (planted and harvested) and oat yield information,
2) calculate long term averages for oat yields, land area harvested, land area planted, and total production, and
3) identify yield and land use trends on a state and county basis.

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[1]Contribution from the Plant Science Department and the South Dakota Agricultural Experiment Station, South Dakota State University, Brookings 57007. Project H-151.

[2]Associate Professor of Soils, Plant Science Department, South Dakota State University, Brookings, 57007.

This bulletin is meant to point out county average values and does not provide detailed farm specific information. It is designed to serve as a guide for seed dealers, farmers/ranchers, bankers, real estate brokers, state officials, and others who evaluate soil productivity, land values, and land use.

STUDY LIMITATIONS

Users of the county data presented in this bulletin are cautioned against using this data for individual farms because the information is expressed as average values for either a 5- or 22-year period. For example, the county yield data is averaged over all soils, climatic conditions, and management practices present in a county for the time period studied. Thus wide variations in yields are to be expected when comparing one specific farm with another. The data presented in this bulletin are meant to illustrate county and statewide trends.

GROWTH REQUIREMENTS

Oats are raised in a wide variety of climatic conditions due to the wide diversity of varieties. It is grown on areas not suited for wheat and is raised under a wider variety of climatic conditions than any other cereal (Coffman, 1961). Oats requires more moisture to produce a given unit of dry matter than any other cereal except rice (Kipps, 1970). It does best on well drained, medium textured soils with moderate fertility levels (Van Poyan, 1954; Schery, 1972). It is the least selective as to soil requirements of all the cereals except for rye (Martin, et al., 1976).

The climatic conditions which favor oat production include a cool, moist temperate climate. Most commonly, oats are raised in areas where the average annual precipitation is 15 to 30 inches, (Janick et al. 1981). Soil temperatures of 42° to 48°F are needed for good germination. Generally the most limiting climatic factor is high temperatures (> 90°F) during the months of June and July when the plants are heading and ripening. Maximum daily temperatures over 90°F have been found to significantly reduce oat yields (Brandner, 1978). Growing degree units (GDUs) based on a 40° to 90°F basis have been shown to be effectively related to dryland small grain maturity. On the average, most small grains (including oats) require about 175 GDUs from planting to emergence, about 1000 GDUs from emergence to heading, and about 1000 GDUs from heading to harvest, or a total of 2200 GDUs from planting to harvest (Ramirez and Bauer, 1974).

The environmental conditions (both climate and soils) found in South Dakota favor small grain production as evidenced by the large acreage, the high total production, and by the fact that oats is raised in every county of the state.

Oats is an important crop to South Dakota (Reeves and Sraon, 1976). It is raised primarily for livestock use. The crop is easy to plant, handle, harvest, and has a high nutritional feed value. In addition, it is used in rotations and in erosion control work. All of these uses plus favorable climatic conditions are reasons why oats is important to South Dakota.

SOUTH DAKOTA CLIMATE

South Dakota has a continental climate with extremes of summer heat, winter cold, and rapid fluctuations of temperature. Cold winter (< -20°F) and warm summer (>100°F) temperatures are common in most areas of the state. Cold fronts moving across the state may cause temperatures to drop 40° to 60°F in 24 hours (Spuhler, et al., 1971). The average annual temperature is 46°F and ranges from 48°F in the south to less than 44°F in the north (see Figure 1). The total number of days with temperatures greater than 90°F from May 15 to July 31 ranges from 8 (excluding the Black Hills) in the northeast to more than 26 in the south-central (see Figure 2). July average temperatures, which also significantly influence oat yields, are shown in Figure 3. For the area excluding the Black Hills the average last spring killing frost (28°F) date is about April 25 in the southeast to May 14 in the northwest (Decker, 1967; Statistical Reporting Service, 1984).

Since most oats is planted after April 1 and is ripe by July 31 (Ranek and Mannie, 1980), the maps in Figure 4 and Table 1 were developed to give a rough estimate of the number of GDUs available for small grain production in all areas of the state on different dates. This is similar to the work done by Derscheid and Lytle in 1977 and Lytle in 1984. If the planting date is later than April 1, the GDUs available can be estimated from Table 1 and one can estimate when the crop will be ready for harvest. The GDUs were calculated by subtracting a base temperature (40°F) from the average of the maximum and minimum daily temperatures. Since oats grows best in temperatures of 40° to 90°F, those were selected as the extremes. Minimum temperatures below 40°F were counted as 40°F and temperatures greater than 90°F were counted as 90°F. The mathematical formula used to calculate the GDUs was:

$$GDUs = \frac{(\text{Max temp} + \text{Min temp})}{2} - 40°F$$

where:

GDUs = growing degree units;
max temp = daily maximum temperature 90°F or less; and
min temp = daily minimum temperature 40°F or more.

Annual precipitation ranges from 24 to 25 inches in the southeastern part to less than 14 inches in the northwestern part (see Figure 1). Most precipitation occurs during the spring and early summer. Approximately 60% of the total annual precipitation falls when temperatures are ideal for oat growth, April 1 to July 31 (see Figure 5). A recent study by Kenefick et al. (1984) has shown that oat yields were significantly related to climatic variables over a 17-year period in 16 South Dakota counties studied. Growing season precipitation (May thru July) was found to have the greatest influence on oat yields in the studied counties. Much of the precipitation received during the months of June and July comes as short, hard showers of the convectional thundershower type. During April and May most of the moisture falls as frontal precipitation as a result of condensation when warm, moist air from the Gulf of Mexico overrides cool, heavier, polar air.

Figure 1. Average Annual Precipitation and Air Temperature for South Dakota. a = Precipitation (inches) and b = Air Temperature (F).

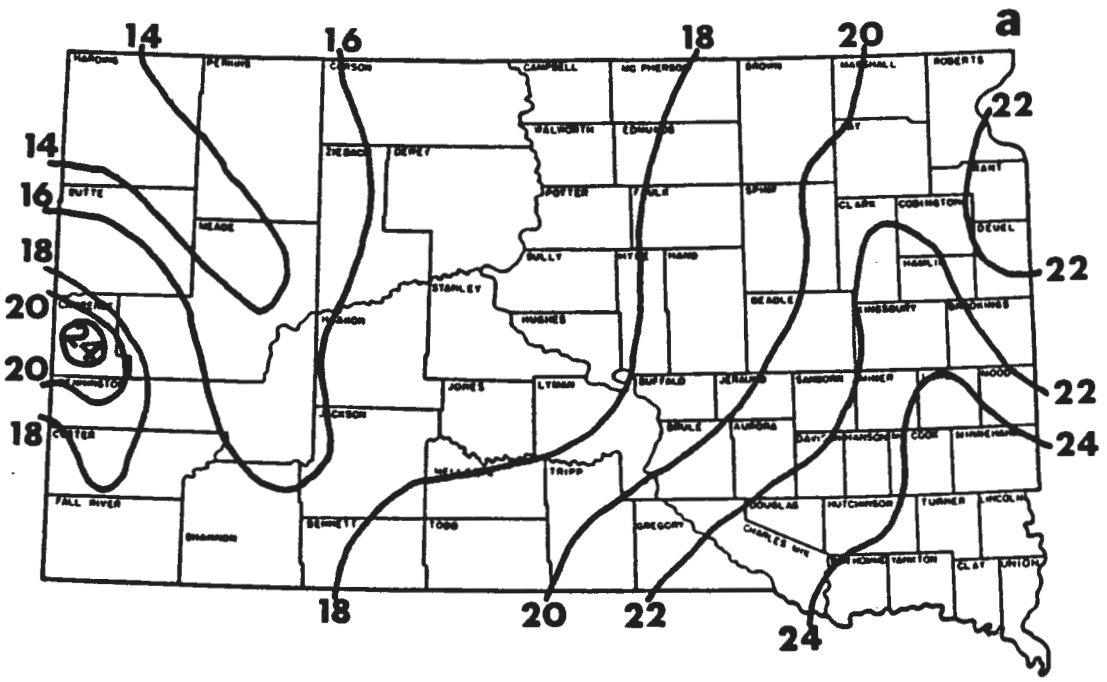
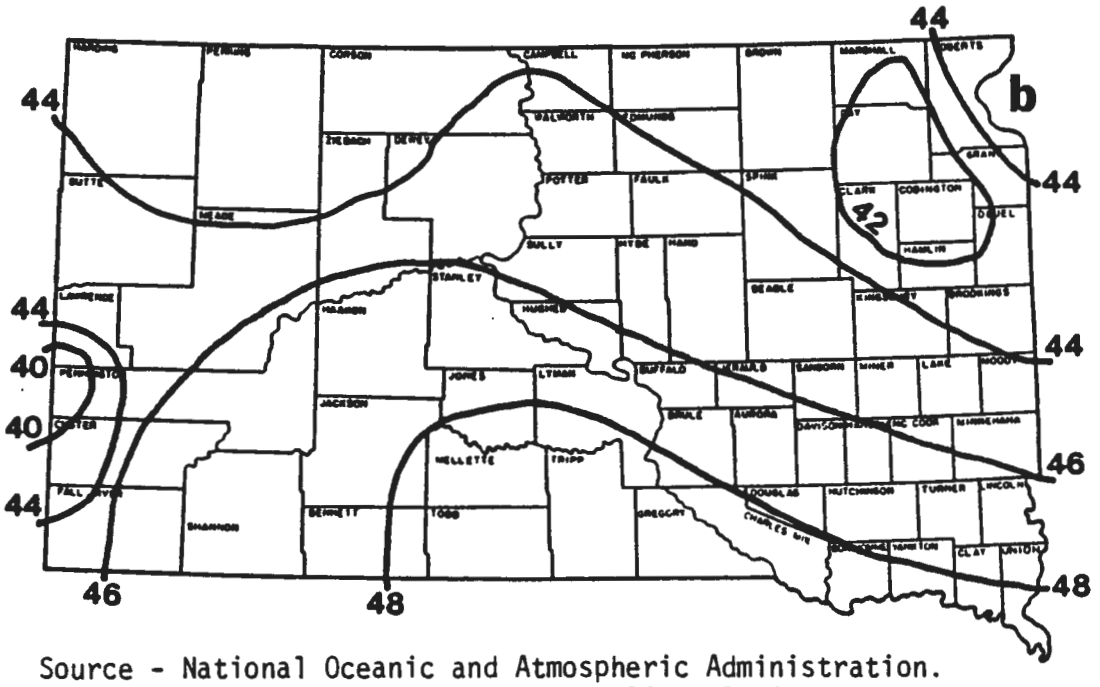


Figure 1b.



Source - National Oceanic and Atmospheric Administration. Environmental Data Service Climatological Data, 1982.

Figure 2. Average Total Number of Days with Daily Maximum Temperature >90°F for Period of May 15 to July 31.

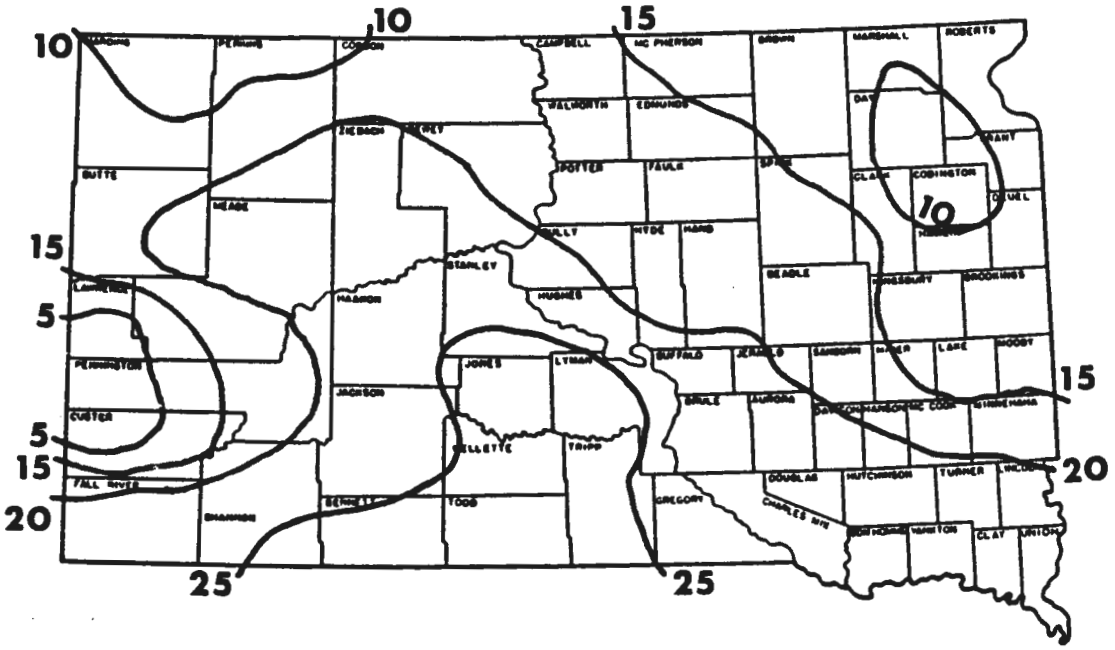
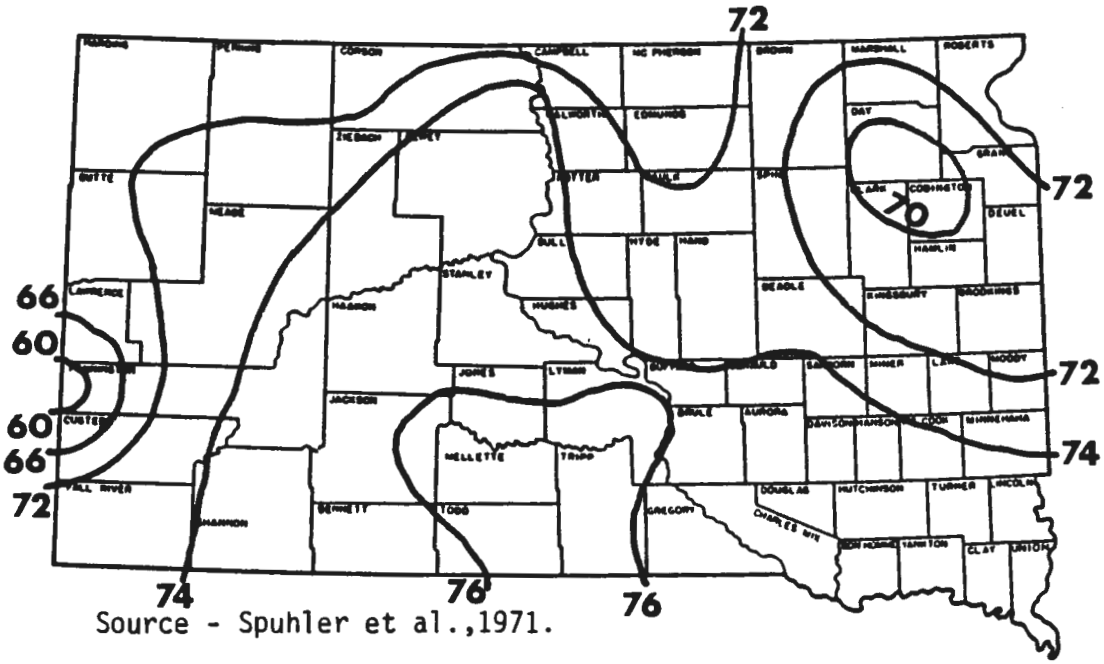
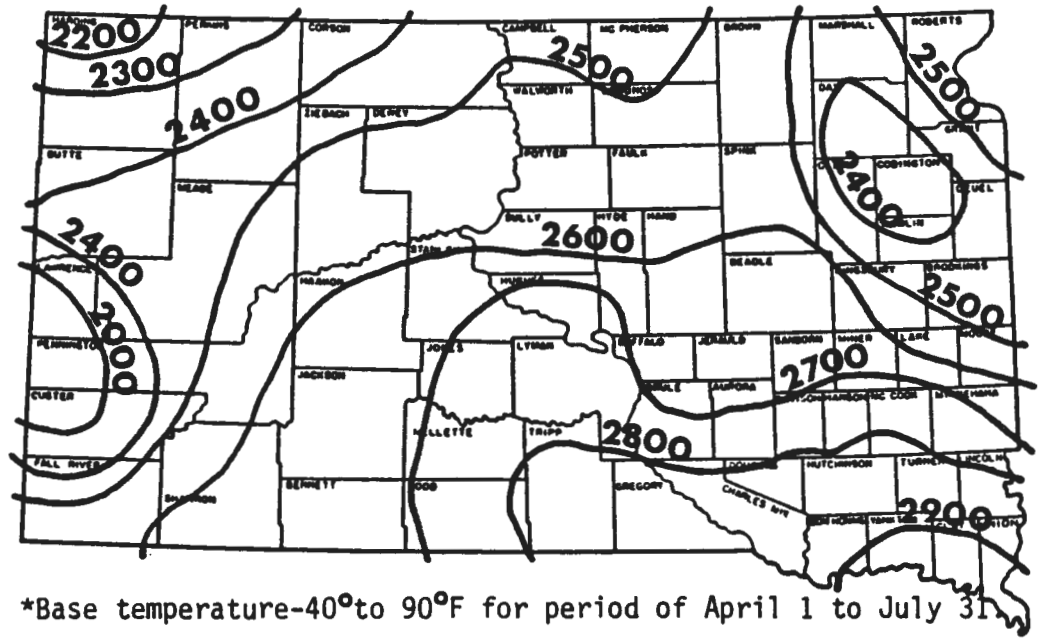


Figure 3. July Average Mean Air Temperature (°F)



Source - Spuhler et al.,1971.

Figure 4. Average Growing Degree Units for South Dakota.*



*Base temperature-40°to 90°F for period of April 1 to July 31.

Figure 5. Percentage of Annual Precipitation Falling During April 1 to July 31.

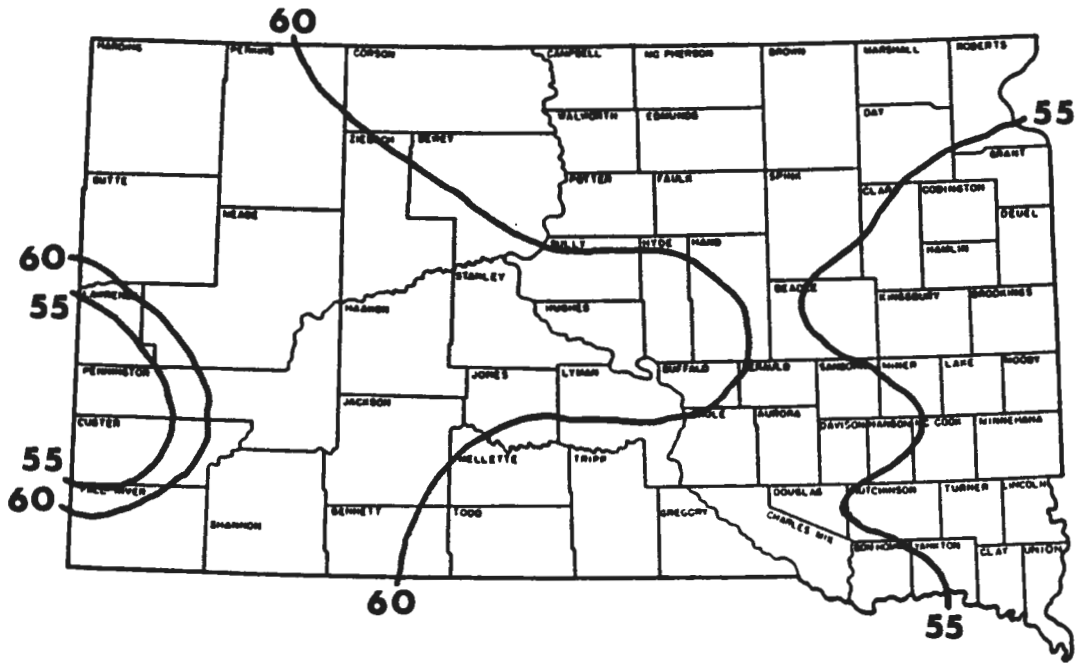


Table 1. Average Growing Degree Units (GDUs)-Base Temperature 40°F to 90°F for period April 1 to July 31.

Town	Accumulated GDUs from April 1 to date listed				
	April 15	April 30	May 31	June 30	July 31
Aberdeen	87	264	782	1557	2532
Academy	102	308	882	1717	2772
Alexandria	101	312	913	1760	2805
Armour	103	320	931	1794	2869
Belle Fourche	98	293	777	1489	2432
Britton	75	240	740	1490	2430
Brookings	86	260	768	1538	2491
Camp Crook	88	261	692	1382	2312
Canton	108	317	937	1787	2838
Cottonwood	103	312	827	1617	2637
Dupree	93	279	793	1553	2568
Eureka	81	265	740	1459	2409
Forestburg	98	290	845	1650	2650
Gann Valley	100	300	839	1629	2634
Gettysburg	82	255	754	1514	2539
Highmore	91	276	788	1548	2573
Hot Springs	98	297	787	1512	2492
Huron	90	273	816	1631	2681
Kennebec	106	321	882	1692	2720
Lead	56	170	492	1092	1952
Lemmon	70	221	652	1348	2285
Long Valley	97	294	827	1602	2622
Ludlow	70	221	627	1271	2162
Mitchell	101	309	901	1736	2766
Mobridge	83	270	776	1556	2536
Newell	76	255	708	1433	2393
Pierre	96	290	860	1694	2764
Pine Ridge	101	317	847	1622	2642
Rapid City	81	248	716	1447	2417
Redfield	90	284	823	1618	2633
Redig	75	230	645	1301	2211
Sioux Falls	77	255	822	1652	2682
Sisseton	80	240	770	1552	2537
Timber Lake	90	268	782	1508	2463
Tyndall	115	330	953	1823	2888
Vermillion	120	336	987	1872	2940
Watertown	75	227	695	1433	2355
Webster	73	220	685	1378	2331
Wentworth	80	272	811	1611	2591
Winner	107	321	919	1759	2824
Wood	115	338	908	1728	2789

DATA SOURCES AND ANALYSIS PROCEDURES

Crop yields, acres planted, and harvest acreage for each county for the years 1961 to 1982 were obtained from USDA Statistical Crop Reporting Service records. These data represent the most accurate and complete data set available. For statewide and national use these data have been found to be accurate to within 2% of actual values while on a county basis the data are accurate to within 5-10% of actual values (McQuigg and Stromman, 1976; Kenefick et al. 1984). Previous years were not considered in this study because they had been partially summarized earlier (Jones et al.1944). Lamberton and Alley (1981) examined oat production by crop reporting districts for 1964 to 1978.

The data were entered into a computer file for storage, data analysis, and future activities. The data were analyzed and graphed using the SAS computer package (Ray, 1982; Council and Helwig, 1981).

STATE TRENDS

Yield

Oat yields have been steadily increasing since 1961 (see Figure 6a). The increase in yields is due to advances in farm technology which include new oat varieties; improved fertility management; and better pest control of insects, weeds, and plant diseases (Malo, 1979). Since 1961 oat yields have increased from 37 to 50 bu/a or a 35% increase over the 22-year study period. The wide scatter of data points in Figure 6a is due to wide climatic fluctuations. For example in 1976, 1980, and 1981 severe droughts struck the state; while in 1977 and 1982 above average precipitation was received. Even with all the precipitation variation which greatly caused oat yields to fluctuate, there was a definite yield increase trend.

Land Area Planted

Since 1961 there has been a steady significant decline in land area planted to oats (Figure 6b). The decline is primarily due to the introduction of new crops like sunflowers and soybeans and increased demand for other feed grains like corn, sorghum, and barley (Martin, et al. 1976). Note the large increase in acres planted in 1977. This represents a response to the drought of 1976 which caused farmers to plant small grains like oats because soil moisture levels were very low. Since 1961 the acres planted to oats have declined from 2.75 million acres to 2.4 million acres or an average loss of 16,000 acres per year since 1961. This represents a 13% reduction in acres planted to oats since 1961.

Planted Acreage Harvested for Grain

The percentage of the acreage planted that is harvested for grain has steadily declined since 1961 (see Figure 6c). One of the reasons for this decline is because a larger percentage of the acres planted is being harvested as oatlage, green-chop, or as hay for livestock feed. Since 1961 there has been a reduction from 93 to 76% of the acres planted actually harvested for grain. The low percentage of planted acres harvested for grain in 1976 was due to the severe drought while the high percentage in 1982 was due to the above average precipitation level received.

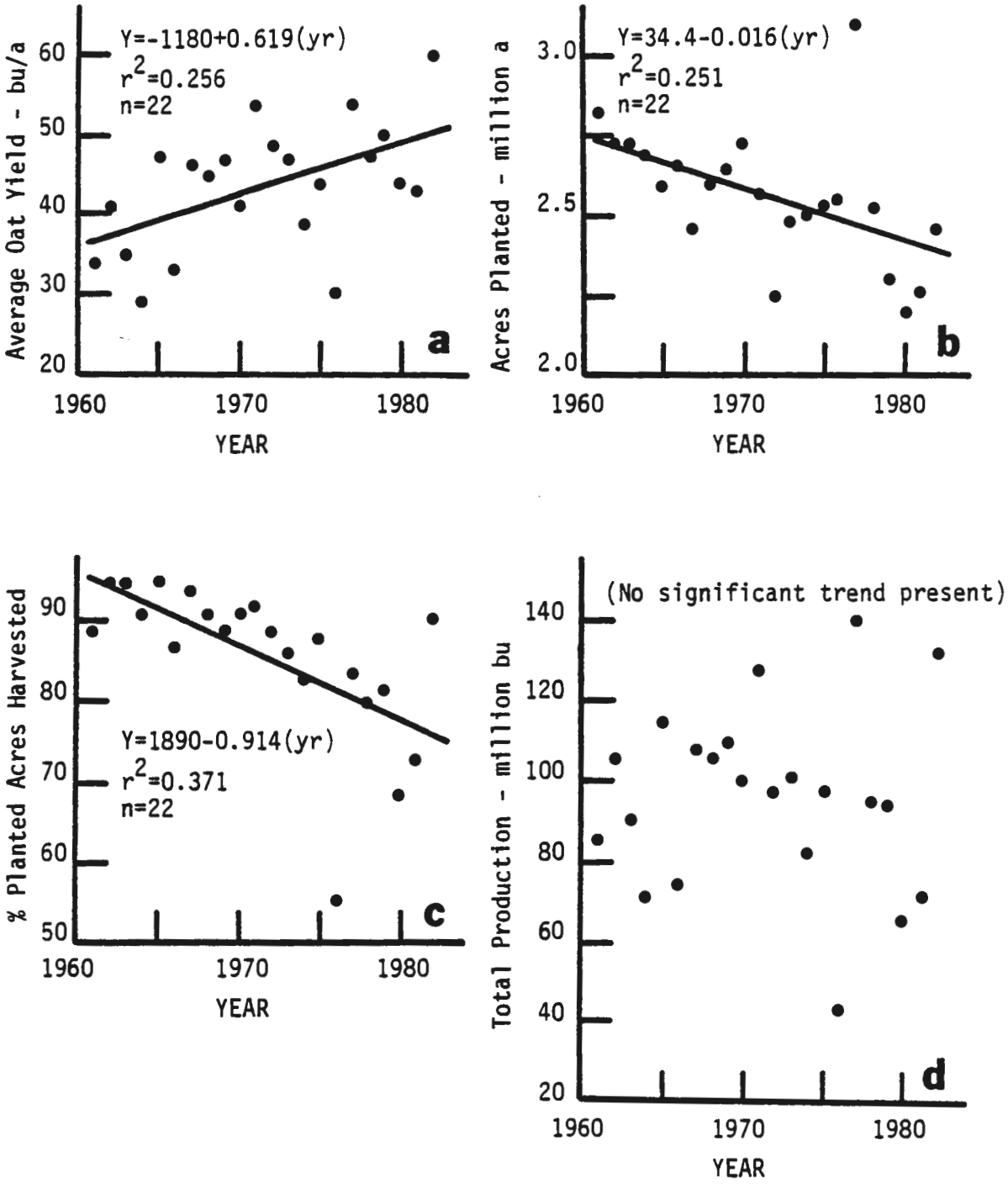


Figure 6. State Oat Production Trends (1961 to 1982). a = Yield, b = Acres Planted, c = Percentage of Planted Acreage Harvested for Grain, and d = Total Production.

Total Production

There has been no significant increase or decrease with time in total oat production since 1961. Climatic events have had significant impact on oat production (for example the droughts of 1976, 1980, and 1981; above normal precipitation of 1977 and 1982). Even though the acreage planted is declining and the acres actually harvested for grain are declining the yield increases per acre are keeping the total oat production in South Dakota constant, near 95 million bushels each year.

COUNTY TRENDS

Yield

The 22-year average county oat yields range from 55 bu/a for Moody County to 29 bu/a for Custer and Fall River counties (see Figure 7a). Similar yield trends were also noted during the last five years (1978 to 1982) of the study (see Figure 7b). Highest average yields during both time periods were found along the eastern border where the soils (Udic Ustolls and Udic Borolls) formed under a warm or cool, moist subhumid climate with tall-grass vegetation in glacial drift or alluvial parent materials (Westin and Malo, 1976). The lowest yields were found in the southwestern corner of the state where the soils (Aridic Ustolls) formed under a warm, semi-arid climate with short-grass vegetation in residual parent materials. The low yields were caused by unfavorable environmental conditions (low total annual precipitation, low amounts of effective growing season precipitation, a large number of hot days with temperatures >90°F, and soils which have a lower capability) for oat production.

In the last 5 years (1978 to 1982) oat yields have increased significantly when compared to 1961 to 1965 averages in the southeastern corner of the state (see Figure 7c). Increases of 30 to 50% are common in this part of the state while little change or even yield declines have been experienced in other parts of the state. Part of the reason why yield increases are minimal in the north-central and southwestern parts of the state was that a severe drought struck these areas during the growing seasons of 1980 and 1981 causing greatly lowered yields. The greatest average yield increases were found in Turner, Douglas, and Union counties while the greatest average yield declines were noted in Jackson (Washabaugh), Shannon, and Lawrence counties. The large yield increases experienced in the southeastern part of the state are partially due to improved soil management and weed control associated with row crops such as corn and soybeans and with the development of new higher yielding oat varieties (such as Lancer, Lang, and Ogle) suited to the environmental conditions present in that part of the state.

Land Area Planted

The largest percentages of total county area planted to oats over the past 22 years are found in an area south and east of a line from Grant to Gregory counties (see Figure 8a). Highest percentages of land area planted to oats (19 to 20%) were found in McCook, Hanson, and Hutchinson counties while the lowest percentages (0.3%) were located in Custer and Shannon counties. The counties of Brookings, Brown, Hutchinson, and McCook have averaged at least 75,000 planted acres/yr of oats while the counties of Custer, Lawrence, and Shannon have had less than 5,000

Figure 7. County Oat Yield Trends. a = Average Yield for 1961 to 1982, b = Average Yield for 1978 to 1982, and c = Percent Change in Mean Yield (PCMY) - 1978 to 1982 Average Compared to 1961 to 1965 Average.

Figure 7a.

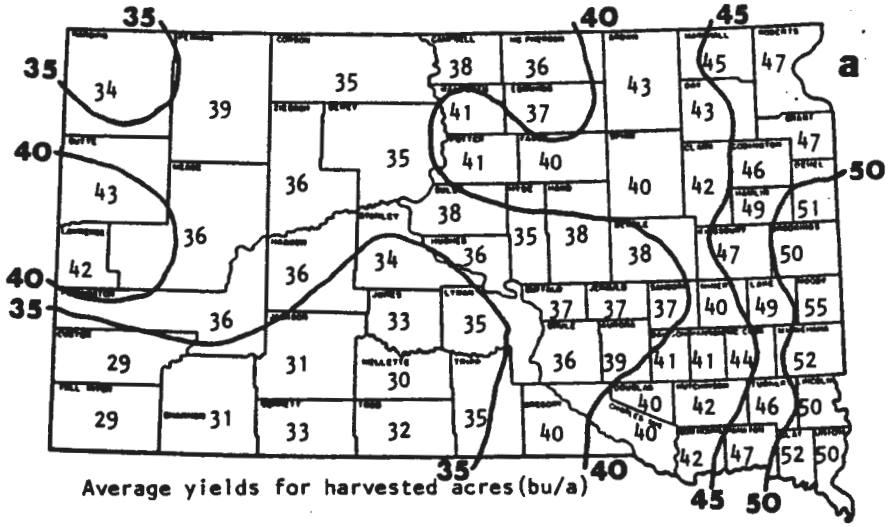


Figure 7b.

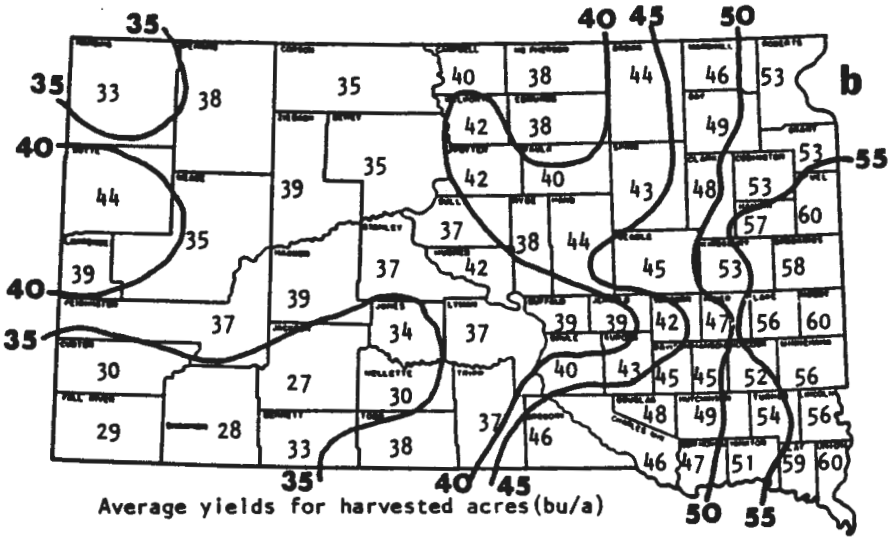


Figure 7c.

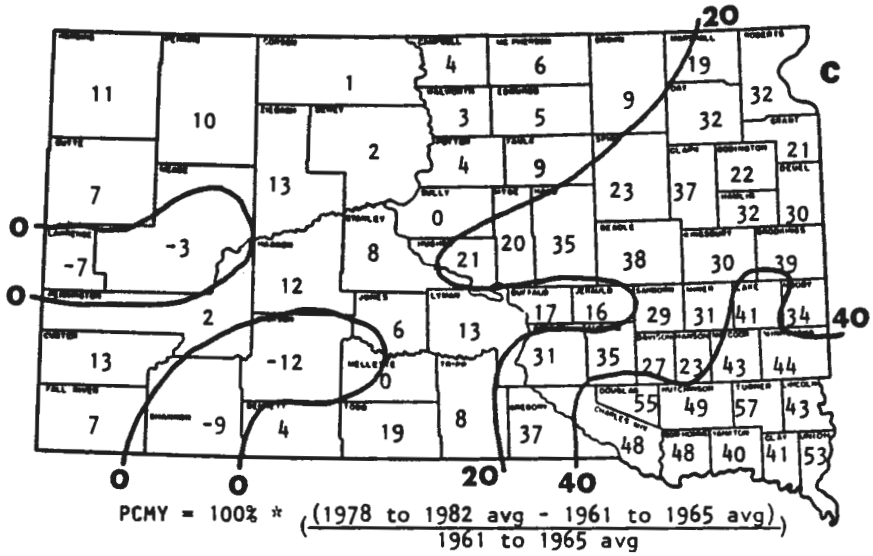
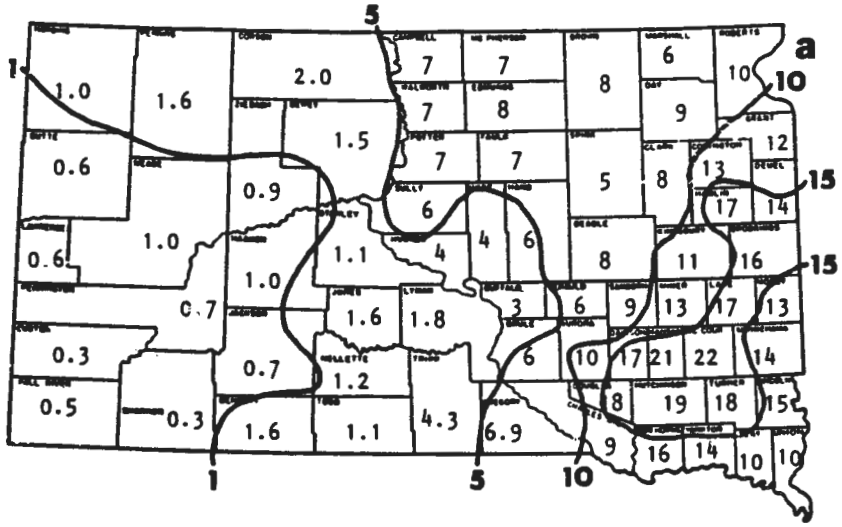


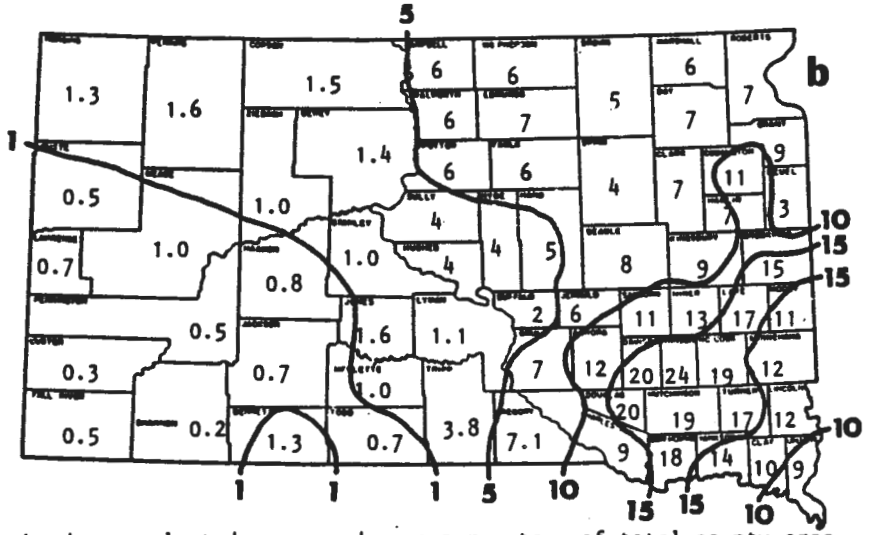
Figure 8. Land Area Planted-County Trends. a = Average Percentage of County Area Planted (1961 to 1982), b = Average Percentage of County Area Planted (1978 to 1982), and c = Percent Change in Area Planted (PCAP) - 1978 to 1982 Average Compared to 1961 to 1965 Average.

Figure 8a.



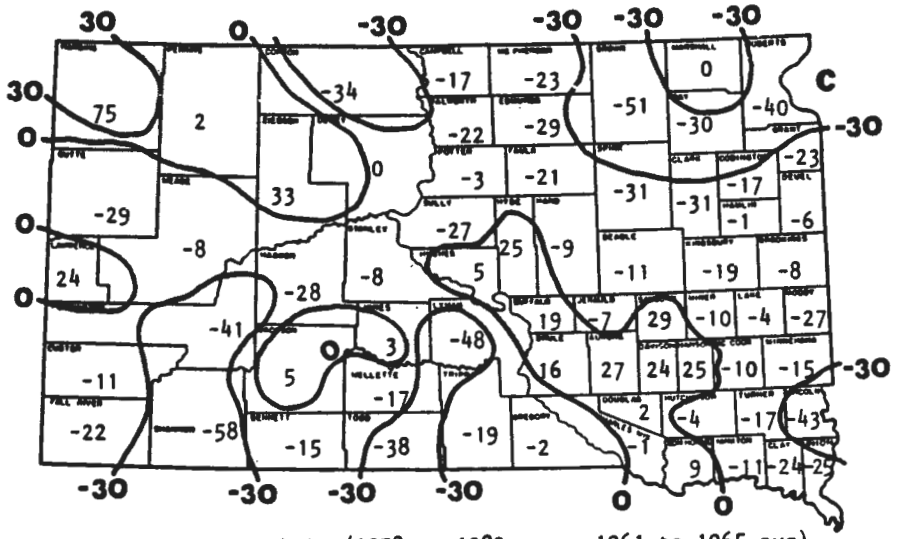
Land area planted expressed as a percentage of total county area.

Figure 8b.



Land area planted expressed as a percentage of total county area

Figure 8c



$$PCAP = 100\% * \left(\frac{(1978 \text{ to } 1982 \text{ avg} - 1961 \text{ to } 1965 \text{ avg})}{1961 \text{ to } 1965 \text{ avg}}\right)$$

acres planted/yr. The low acreages seeded to oats in the southwest corner of the state are the result of low average oat yields and less favorable environmental conditions.

In the last 5 years this trend has not changed much (see Figure 8b). Since 1961 the acreage of oats in Minnehaha County has increased to average more than 75,000 planted acres/yr while Fall River County now averages less than 5,000 planted acres/yr. There has been a concentrating of oat production in the southeastern corner of the state. The loss of land area planted to oats in the northeastern and north-central parts of the state is probably due to the advent of sunflower production in these areas. The soils in this area (Typic Borolls) formed under a cool, dry subhumid climate with mid-grass vegetation in glacial drift parent materials. The total land area in acres for each county is presented in Table 2.

Even though there has been a significant decline in total acres planted to oats in the state since 1961, some counties (Aurora, Davison and Hanson) have had average increase of at least 11,000 acres planted to oats over the 22-year period (see Figure 8c). This increase in acreage planted to oats near the Missouri River in the south-central part of the state is probably in response to the drought conditions experienced in 1980 and 1981 and the introduction of new high yielding adapted varieties. Since farmers in this area often need good quality feed and forage for livestock and/or a marketable commodity, oats has been selected to meet this need in light of current environmental conditions. The soils in this area (Typic Ustolls) formed under a warm, dry subhumid climate with mid-grass vegetation in either glacial drift, loess, alluvial, or residual parent materials.

Counties like Harding, Ziebach, and Lawrence have also had large increases (on a percentage basis). However, the total acreage involved is low when compared to counties east of the Missouri River. The main reason for this increase in oat plantings in the northwestern part of the state is the use of oats as a forage crop (personal communication with Dale Reeves) on less favorable soils (Aridic Borolls) which have formed under a cool, semi-arid climate with short-grass vegetation in residual parent materials.

Large acreage reductions (>20,000 acres) in oats were found in Brown, Roberts, Spink, and Clark counties (see Figure 8c). During the 22-year study period Brown County has lost over 50,000 planted acres (50% of 1961 to 1965 average planted acreage). In addition to the northeast and north-central parts of the state where oats acreage has declined due to sunflowers, the southeastern corner has also experienced a decline in oat acreage due to soybeans. Lincoln County has lost over 20,000 acres during the 22-year period. Other counties west of the Missouri River (Shannon, Todd, and Tripp) have also had large percentage decreases in total acres planted; however, the total acreage lost was quite low compared to the total acreage lost elsewhere in the state. The development of high yielding sorghum varieties has lowered the acreage planted to oats in the southwestern part of the state.

Planted Acreage Harvested for Grain

There was a significant difference in the percentage of planted acreage actually harvested for grain when comparing different parts of

Table 2. County Land Area

County	Total Land Area* (a)	County	Total Land Area* (a)
Aurora	454,016	Jerauld	337,216
Beadle	806,464	Jones	622,528
Bennett	756,032	Kingsbury	523,328
Bon Homme	358,464	Lake	362,560
Brookings	511,936	Lawrence	512,000
Brown	1,071,296	Lincoln	368,640
Brule	523,392	Lyman	1,077,120
Buffalo	308,224	McCook	368,128
Butte	1,439,680	McPherson	734,016
Campbell	468,736	Marshall	542,784
Charles Mix	702,272	Meade	2,217,792
Clark	616,640	Mellette	835,840
Clay	259,456	Miner	364,672
Codington	439,488	Minnehaha	520,384
Corson	1,580,928	Moody	334,656
Custer	996,480	Pennington	1,778,688
Davison	276,672	Perkins	1,830,464
Day	659,200	Potter	555,904
Deuel	408,768	Roberts	709,312
Dewey	1,504,576	Sanborn	364,672
Douglas	278,272	Shannon	1,344,128
Edmunds	738,432	Spink	963,136
Fall River	1,115,584	Stanley	904,960
Faulk	637,120	Sully	642,560
Grant	435,904	Todd	888,000
Gregory	638,336	Tripp	1,036,480
Haakon	1,162,304	Turner	391,424
Hamlin	326,912	Union	289,216
Hand	916,480	Walworth	459,328
Hanson	275,392	Yankton	332,032
Harding	1,716,480	Ziebach	1,267,776
Hughes	478,400		
Hutchinson	521,536		
Hyde	552,192		
Jackson	1,196,096	STATE TOTAL	48,611,904

* 1960 Census Data.

REFERENCE: Area Measurement Report 1960 - Bureau of Census, GE-20, No. 43. March 1967.

the state (see Figure 9a). The eastern third of the state harvested over 90% of the planted oat acreage for grain while the western third harvested only 45 to 60% of the planted acres on the average during the 22-year study period. The counties of Brookings, Brown, McCook, and Hutchinson have averaged over 70,000 harvested acres of oats while the counties of Custer, Fall River, Lawrence, and Shannon have had less than 3,000 acres harvested for grain/yr.

In the last five years this trend has shifted downward (see Figure 9b). More and more oats is being harvested as forage, causing a lowering of the percentage of planted acres being harvested for grain, especially in the southeast and northwest corners of the state. Counties in the east-central part of the state still harvest at least 90% of the planted acres for grain. During this time period (1978 to 1982) only two counties, Brookings and Hutchinson, have averaged over 70,000 harvested acres while the counties of Buffalo, Custer, Fall River, Lawrence, and Shannon have averaged less than 3000 acres harvested for grain/yr.

Since 1961 there has been a steady statewide decline in the percentage of planted acres harvested for grain (see Figure 9c). The greatest increase in acres planted but not harvested for grain was in Aurora, Beadle, Brown, Brule, Hand, and McPherson counties where at least 10,000 more planted acres are not being harvested for grain (based on a comparison of 1978 to 1982 averages with 1961 to 1965 averages). The least increase in acres planted but not harvested for grain during the 22-year study period was in Butte, Clay, Codington, Corson, Lincoln, Pennington, Shannon, and Todd counties where there was less than a 500 acre increase in planted acres not harvested for grain.

Total Production

The total county average oat production ranges from a high of 3.9 million bu/yr in Brookings and Hutchinson counties to a low of less than 0.1 million bu/yr in Custer County for the 22-year study period (see Figure 10a). Seven counties (Brookings, Brown, Hutchinson, McCook, Minnehaha, Roberts, and Turner) have averaged at least 3.0 million bu/yr, while most counties west of the Missouri River (except Tripp and Gregory) have averaged less than 1.0 million bu/yr. The greatest oat production area in the state is located in an area south and east of the line from Roberts to Charles Mix counties.

Similar total oat production trends were noted in the 5-year study period (see Figure 10b). There were two new counties (Hamlin and Deuel) producing at least 3.0 million bu/yr, while the oats production in Brown County fell to 1.7 million bu/yr during 1978 to 1982.

Even though total state oat production has not significantly changed since 1961, there have been significant changes in county total production values (see Figure 10c). The counties of Brookings, Lake, Davison, Hanson, Hutchinson, and Bon Homme have had at least a 650,000 bu/yr increase in total oat production from 1961 to 1982. The greatest loss of production has occurred in the north-central and northeastern parts of the state. The counties of Brown, Edmunds, McPherson, and Roberts have all had at least an 800,000 bu/yr decline in total oat production from 1961 to 1982. The increased popularity of sunflowers has caused this major decline in oat production because fewer acres are being planted to oats. Other crops like sorghum in the southwest and soybeans in the southeast have significantly lowered total oat production or slowed the rate of increase in total oat production in some counties.

Figure 9. Percentage of Planted Acreage Harvested for Grain-County Trends. a = Average Percentage of Planted Acreage Harvested for Grain (1961 to 1982), b = Average Percentage of Planted Acreage Harvested for Grain (1978 to 1982), and c = Percentage Change in Planted Acreage Harvested for Grain (PCPAH) - 1978 to 1982 Average Compared to 1961 to 1965 Average.

Figure 9a.

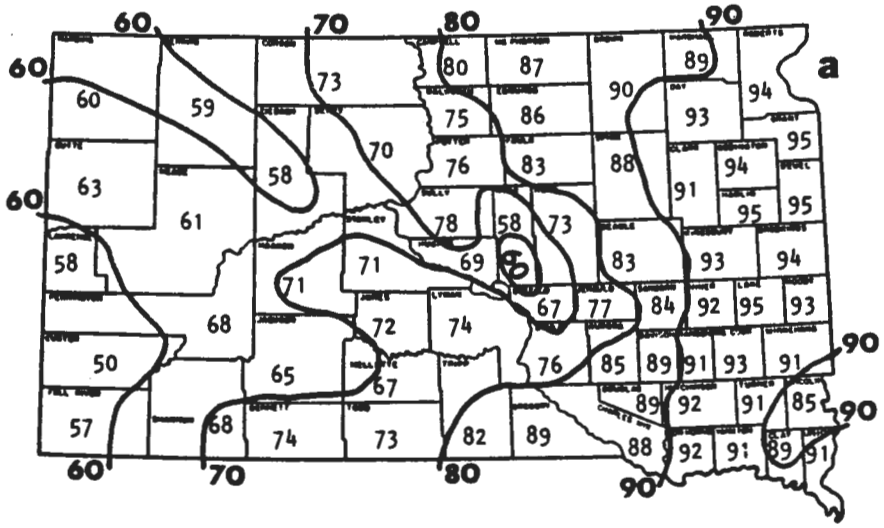


Figure 9b.

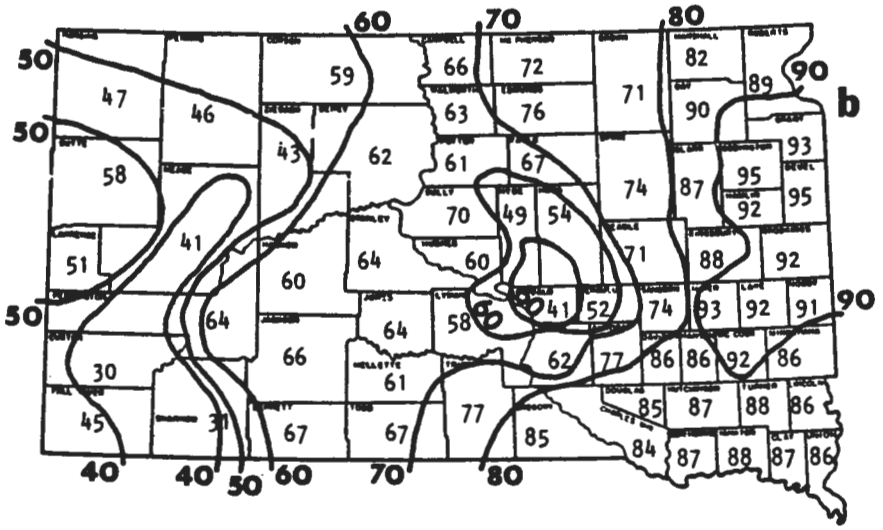
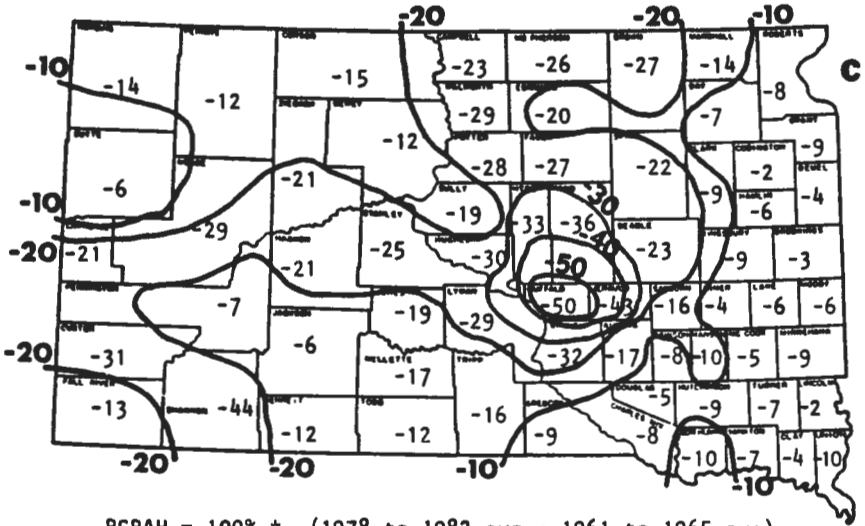


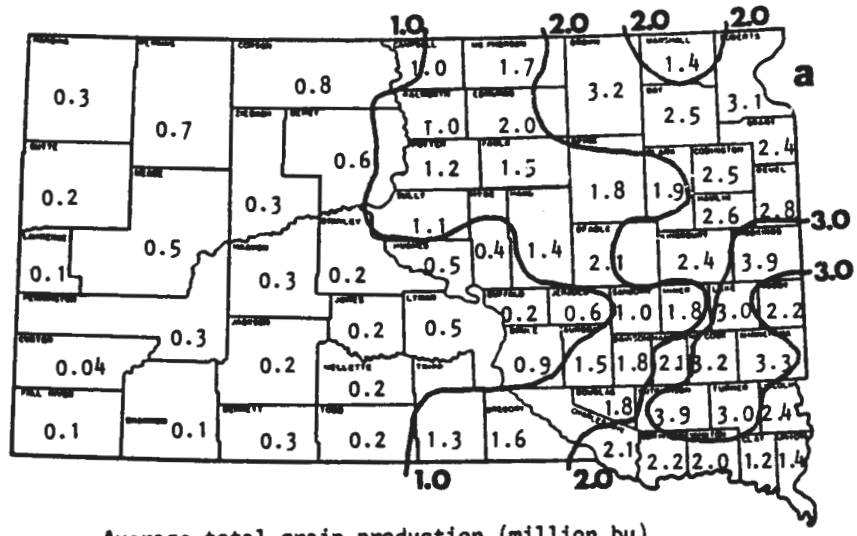
Figure 9c.



$$PCPAH = 100\% * \left(\frac{(1978 \text{ to } 1982 \text{ avg} - 1961 \text{ to } 1965 \text{ avg})}{1961 \text{ to } 1965 \text{ avg}}\right)$$

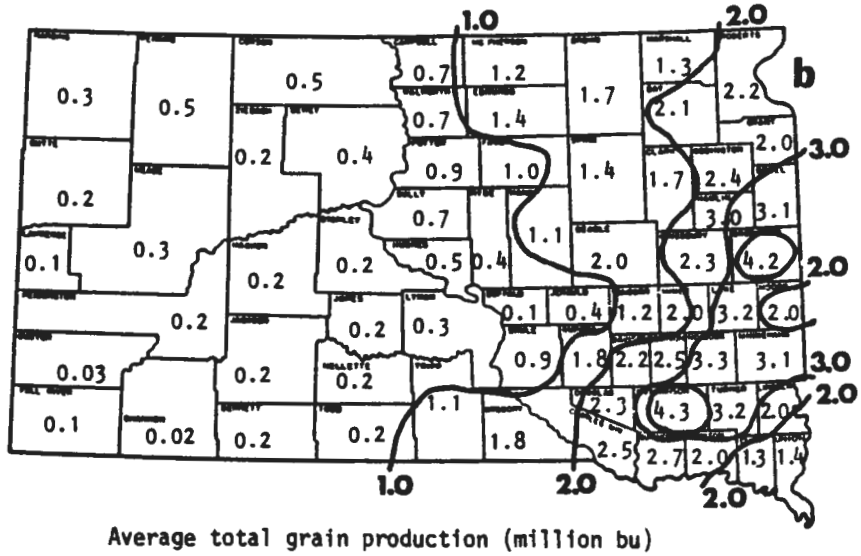
Figure 10. County Total Production Trends. a = Average Total Production for 1961 to 1982, b = Average Total Production for 1978 to 1982, and c = Percent Change in Total Production (PCTP) - 1978 to 1982 Average Compared to 1961 to 1965 Average.

Figure 10a.



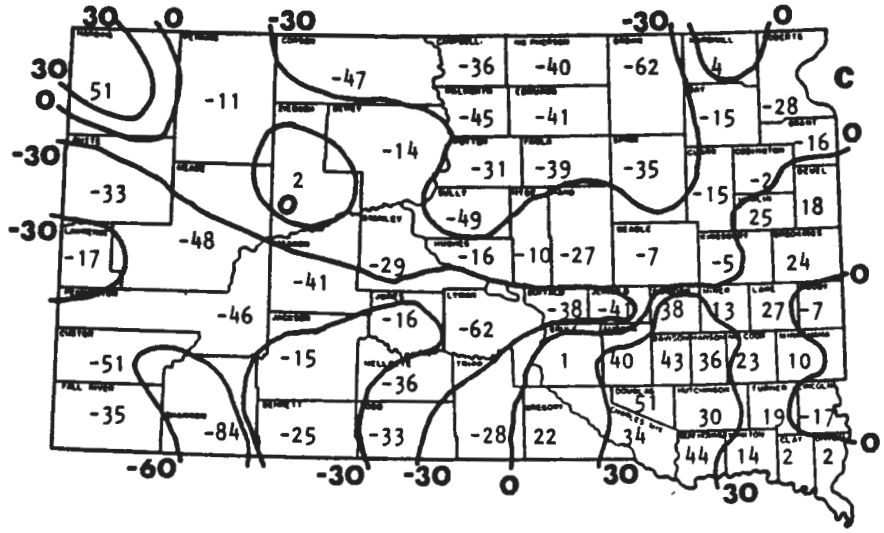
Average total grain production (million bu)

Figure 10b.



Average total grain production (million bu)

Figure 10c.



PCTP = 100% * $\left(\frac{\text{(1978 to 1982 avg - 1961 to 1965 avg)}}{\text{1961 to 1965 avg}}\right)$

SUMMARY

Historical planting and yield records (1961 to 1982) for South Dakota oat production were analyzed to determine if significant changes/trends in land use and yield had occurred on a statewide and/or county basis. The computer files created by this study contain yield, acres planted, and acres harvested data and will be updated as new data becomes available.

The major state trends observed in this study were:

1. GDUs, growing season precipitation, and the number of June and July days with temperatures >90°F were useful in delineating the major oat producing regions;
2. average annual oat yields have increased at a rate of 0.5 bu/a/yr;
3. the average number of acres planted to oats has declined at a rate of 16,000 a/yr;
4. the percentage of planted acres harvested for grain has declined from 93 to 76%; and
5. total annual oat production has remained constant at 95 million bu/yr.

The major county (regional) trends observed in this study were:

1. highest oat yields and yield increases (1961 to 1982) were found in southeastern and east-central South Dakota;
2. planted oat acreage has increased in the south-central area near the Missouri River and in the northwest corner of the state:
3. the greatest loss of oat acreage has occurred in the northeastern and north-central parts of the state; and
4. the greatest oat grain production areas were southeastern and east-central South Dakota.

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