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# 1981 Report of Agricultural Research, Southeast Kansas Branch Station

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Agricultural Experiment Station
Kansas State University, Manhattan
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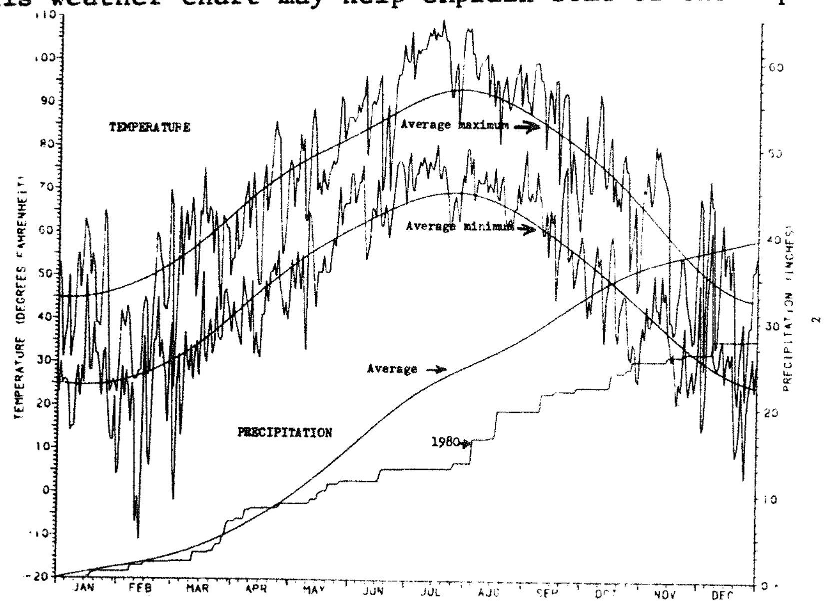
# 1981 Report Of Agricultural Research

## INTRODUCTION

This annual research report is to inform area farmers of what is being attempted and accomplished at the Southeast Kansas Branch Experiment Station to serve the area. During 1980 the Station headquarters was moved from Mound Valley to Parsons, the location of one of the units of the Station since 1967. Effort at the Mound Valley location continues without reduction. The third unit of the Station is near Columbus.

This report covers four areas of research emphasis: crops, forages, beef cattle, and soil and water management. The information is intended for producers, industry cooperators, and other interested persons.

Page two is a summary chart of temperature and precipitation for 1980. Effects of weather sometimes make it impossible to interpret experimental results. This weather chart may help explain some of the reported results.




GRAPHICAL WEATHER SUMMARY FOR PARSONS 1980

PRODUCED WITH THE AID OF THE KANSAS AGRICULTURAL EXPERIMENT STATION WEATHER DATA LIBRARY

Contribution no. 81-313-S, Southeast Kansas Branch Experiment Station, Parsons, and Kansas Agricultural Experiment Station, Kansas State University, Manhattan.

CONTENTS

## CROPS RESEARCH

Kenneth W. Kelley
Crops Agronomist

### Small Grain Variety Performance Tests

The small grain variety test is to help southeastern Kansas growers select winter wheat, barley, and spring oat varieties best suited for the area.

Procedure: In 1980, 25 wheat varieties, four barley varieties, three winter oat varieties, and seven spring oat varieties were compared. Plots were fertilized with 70 lbs N, 50 lbs $P_2O_5$, and 50 lbs $K_2O$ per acre.

Wheat results: Yields in 1980 averaged 55 bushels per acre with Hart and Vona the top yielders at 59 bushels per acre. Three-year averages and 1980 results with the more popular varieties are listed below:

| Variety | 1980 Yield, bu/a | 1978-80 Yield, bu/a |
|---|---|---|
| Agripo Wings | 57 | 57 |
| Centurk 78 | 55 | 55 |
| Hart | 59 | 58 |
| Newton | 55 | 55 |
| Parker 76 | 55 | 56 |
| Payne | 55 | 59 |
| Tam W-101 | 58 | 56 |
| Triumph 64 | 52 | 50 |
| Vona | 59 | 59 |
| LSD .05 | | 3 |

Wheat conclusions: Semi-dwarf varieties have yielded 5 to 10 bushels more per acre than the commonly grown Triumph variety. Soft wheat varieties, like Hart, also have performed well.

Barley results: Two-year averages of three winter barley varieties are as follows:

| Variety | 1979-80 Yield, bu/a |
|---|---|
| Kanby | 63 |
| Post | 78 |
| Paoli | 85 |

Barley conclusions: Paoli and Post varieties have out performed the older Kanby variety.

Winter oat results: Three winter oat varieties were compared in 1980.

| Variety | 1980 Yield, bu/a |
|---|---|
| Okay | 68 |
| Chilocco | 74 |
| Cimmarron | 79 |

Winter oat conclusions: Even though winter oats yielded well in 1980, they frequently winter-kill in southeastern Kansas. Spring oats are a better choice for this area.

Spring oat results: Yields in 1980 were as follows:

| Variety | 1980 Yield, bu/a |
|---|---|
| Lang | 85 |
| Bates | 79 |
| Pettis | 75 |
| Stout | 74 |
| Ill. Exp. | 74 |
| Spear | 71 |
| Trio | 68 |
| LSD .05 | 10 |

Spring oat conclusions: Lang has been the best variety over the past several years. It has good resistance to red leaf disease, which is sometimes a problem when oats are near the heading stage.

## Effect of Seeding Rate on Yields of Selected Wheat Varieties

Semi-dwarf and soft wheat varieties dominate the wheat acreage in southeastern Kansas. The effect of seeding rates on these newer varieties has not been evaluated.

Procedure: For the past three years four varieties (Newton, Hart, Centurk, and Trison) were seeded at 60, 90, and 120 pounds per acre. Plots were fertilized with 70 lbs N, 50 lbs $P_2O_5$, and 50 lbs $K_2O$ per acre.

Results: The effect of seeding rate on final yield within a given variety was rather small in most cases, more pronounced when wheat was planted late in the fall with soil conditions not ideal for germination. Under those conditions (1978), the 120-pounds-per-acre rate gave best results.

Under optimum germinating conditions, 90 pounds per acre seemed to be more desirable. Wheat seeded at 60 pounds per acre normally resulted in good yields, although in one late-fall seeding weeds were more of a problem due to reduced population and less tillering.

Conclusions: Optimum seeding rates for semi-dwarf and soft wheat varieties do not appear to differ from rates for standard varieties. With a late planting, increasing the seeding rate helps off-set reduced tillering. (See Table 1)

Table 1. Effects of seeding rates on wheat yields, Parsons Field.

| Variety | Seeding rate lbs/a | Yield, bu/a 1978 | 1979 | 1980 | 3-yr avg |
|---|---|---|---|---|---|
| Newton | 60 | 33 | 67 | 46 | 49 |
| Newton | 90 | 35 | 67 | 45 | 49 |
| Newton | 120 | 39 | 72 | 44 | 52 |
| Centurk | 60 | 28 | 65 | 44 | 46 |
| Centurk | 90 | 32 | 67 | 43 | 47 |
| Centurk | 120 | 34 | 65 | 42 | 47 |
| Hart | 60 | -- | 65 | 52 | -- |
| Hart | 90 | -- | 69 | 50 | -- |
| Hart | 120 | -- | 71 | 49 | -- |
| Trison | 60 | 21 | 58 | 53 | 44 |
| Trison | 90 | 24 | 59 | 51 | 45 |
| Trison | 120 | 24 | 59 | 48 | 44 |
| Treatment LSD .05 | | 4 | 5 | 5 | -- |
| Mean Values: | | | | | |
| Newton | | 36 | 69 | 45 | 50 |
| Centurk | | 32 | 66 | 43 | 47 |
| Hart | | -- | 68 | 50 | -- |
| Trison | | 23 | 59 | 51 | 44 |
| LSD .05 | | 2 | 3 | 3 | -- |
| 60 lbs/a | | 27 | 64 | 49 | 47 |
| 90 lbs/a | | 30 | 66 | 47 | 48 |
| 120 lbs/a | | 32 | 67 | 46 | 48 |
| LSD .05 | | 2 | 2 | 2 | -- |

Evaluation of Nitrogen Fertility Requirements for Semi-dwarf and Soft Wheat Varieties.

Nitrogen fertility requirements of the higher yielding, semi-dwarf and soft wheat varieties that now dominate the wheat acreage in southeastern Kansas have not been evaluated.

Procedure: In 1980 Newton and Hart varieties were fertilized in the fall or spring with N rates of 30, 60, 90 or 120 pounds per acre. Injecting anhydrous ammonia in the fall and broadcasting urea in the fall or spring were compared.

Results: Wheat yields averaged over all treatments were 60 bushels per acre for Hart (soft wheat) and 57 bushels per acre for Newton (hard wheat). In 1980 nitrogen rates exceeding 90 pounds per acre resulted in no yield benefit for either variety. Average yields for the two varieties at the various N rates were:

| N rate, lbs/a | Yield, bu/a |
|---|---|
| 0 | 47 |
| 30 | 54 |
| 60 | 60 |
| 90 | 63 |
| 120 | 60 |
| LSD .05 | |

There were no significant differences between fall and spring N treatments. Results from applying N as anhydrous ammonia in the fall did not differ from results from applying urea in fall or spring as a broadcast application.

Conclusion: Expanded studies of optimum N rates with semi-dwarf and soft wheat varieties are planned in 1981. Results at this time are inconclusive. But several years' research has shown no significant difference between fall and spring N applications.

Wheat Response to Nitrogen Where Soybeans Were Previously Grown

Wheat often follows soybeans in many cropping rotations in southeastern Kansas. The benefit from any residual nitrogen provided by the soybeans for the next crop, is not fully known.

Procedure: In the fall of 1979, 25-bushel-per-acre soybeans were harvested from a site, which was then planted to wheat (Newton variety). Nitrogen in the form of urea was applied before planting at 20, 40, 60 and 80 lbs of N per acre.

Results: Wheat yields increased in direct proportion to the applied nitrogen.

| N rate, lbs/a | Wheat yield, bu/a |
|---|---|
| 0 | 33 |
| 20 | 40 |
| 40 | 44 |
| 60 | 47 |
| 80 | 49 |
| Treatment LSD .05 | 3 |

Conclusions: In 1980 residual N from soybeans seemed to have little, if any, effect on wheat yields. Our 1981 study will compare wheat grown after wheat with wheat after soybeans.

## Grain Sorghum Hybrid Performance Test

The grain sorghum hybrid performance test is designed to evaluate hybrids from private seed companies for yield and overall performance under southeast Kansas climatic conditions.

Procedure: Sixty hybrids were compared in 1980 at the Parsons field under dryland conditions. They were fertilized with 125 lbs N, 60 lbs $P_2O_5$, and 60 lbs $K_2O$ per acre, and planted May 5.

Results: Due to abnormally dry, hot summer, yields were well below average, ranging from 4 to 41 bushels per acre, with the earlier-maturing hybrids yielding best. Complete grain sorghum yield results for Kansas are compiled in Agric. Expt. Station Report of Progress 391.

Conclusions: This year's results show that grain sorghum will normally make a crop under extremely dry conditions where dryland corn will fail completely.

## Effect of Planting Date on Grain Sorghum Yields of Early, Medium, and Late Maturity Hybrids

Grain sorghum is planted from late April through late June in southeastern Kansas. More information is needed, however, to determine the optimum planting date with respect to hybrids of different maturities.

Procedure: In 1980 six grain sorghum hybrids - representing early (Pioneer 8790 and DeKalb B-38+), medium (Pioneer 8585 and Acco GR1089), and medium-late (Pioneer 8272 and Prairie Valley 708GR) maturities, were planted on four dates (May 2, 13, 30 and June 20). Plots were fertilized with 125 lbs N, 60 lbs $P_2O_5$, and 80 lbs $K_2O$ per acre.

Results: Yields in 1980 were well below average due to an extremely hot, dry summer. Highest grain yields came from the June 20 planting for all three hybrid maturities (Table 2).

Conclusions: Grain sorghum of any maturity planted in mid to late June seems to flower after the expected hot, dry period in late July and early August.

An early May planting also will mature before the hot summer period in some years, however, the early planting is more susceptible to herbicide and cold injuries. More information is needed concerning the optimum maturity range for a given planting date.

Table 2. Effect of planting date on grain sorghum yield with hybrids of early, medium, and medium-late maturity, Parsons Field, 1980.

| Hybrid | Planting date | | | | Means |
|---|---|---|---|---|---|
| | May 2 | May 13 | May 30 | June 20 | |
| Early maturity | - - - - - - - - - -Yield, bu/a- - - - - - - - - - | | | | |
| Pioneer 8790 | 26.7 | 28.1 | 29.5 | 32.3 | 29.2 |
| DeKalb B-38+ | 21.1 | 18.7 | 28.9 | 43.9 | 28.2 |
| Medium maturity | | | | | |
| Pioneer 8585 | 21.9 | 43.4 | 25.6 | 46.2 | 34.3 |
| Acco 1089GR | 18.2 | 32.9 | 30.1 | 42.5 | 30.9 |
| Medium-late maturity | | | | | |
| Pioneer 8272 | 34.8 | 48.3 | 35.5 | 41.4 | 40.0 |
| Prairie Valley 708GR | 19.7 | 34.2 | 31.2 | 41.5 | 31.7 |
| Means | 23.7 | 34.3 | 30.1 | 41.3 | |

LSD .05 Values: Comparing one date with another date within a hybrid = 5.5 bu.
Comparing one hybrid with another hybrid within a planting date = 4.2 bu.

## Evaluation of Grain Sorghum Herbicides

Grain sorghum herbicides are compared to evaluate their effectiveness in controlling the problem weeds commonly found in southeast Kansas sorghum fields.

Procedure: In 1980 we evaluated grain sorghum herbicides currently labeled and several experimental herbicides that have not been approved.

Results: Excellent crabgrass and pigweed control were achieved throughout the growing season with Bicep applied after planting before weeds or sorghum plants emerge. Funk's seed safener apparently prevented crop injury from Bicep. However, some seedling injury was observed where Bladex or Igran was used. Results of labelled herbicides are presented in Table 3. Due to summer drought conditions, grain yields were not obtained.

Conclusions: Where annual grasses are a problem in grain sorghum fields, Bicep seems to give longer residual control than other grass herbicides. One disadvantage, however, is that the safening agent for Bicep has not been available for many of the commonly grown hybrids in the area.

Table 3. Grain sorghum herbicides compared, Parsons Field, 1980

| Herbicide treatments | Rate a.i./a | Control, % | |
|---|---|---|---|
| | | Crabgrass | Pigweed |
| Control | - - - | 0 | 0 |
| Ramrod/atrazine - 4L | 4.0 | 60 | 95 |
| Ramrod-4L + AAtrex nine-0 | 3.0 + 1.25 | 60 | 95 |
| Ramrod-4L + Bladex-4L | 3.0 + 1.0 | 85 | 25 |
| Bexton-4L + AAtrex nine-0 + Bladex-4L | 3.0 + 0.75 + 0.75 | 85 | 95 |
| Ramrod-4L + Modown-4F | 3.0 + 1.0 | 50 | 90 |
| Igran-80W + AAtrex nine-0 1/ | 1.5 + 0.75 | 50 | 60 |
| Bicep-4.5L | 2.7 | 95 | 95 |
| Bicep-4.5L 1/ | 2.7 | 70 | 85 |

1/ Treatments were incorporated shallow with a field cultivator prior to planting.

## Evaluation of Grain Sorghum Herbicides in Reduced Tillage Systems

Reduced tillage systems with grain sorghum will not be practiced by farmers in southeastern Kansas unless weeds can be effectively controlled.

Procedure: Grain sorghum herbicides were compared in two reduced-tillage systems. In one system, grain sorghum was planted with no tillage (no-till) where soybeans were previously grown. In the other system the land was disced once early in the spring and then in early May grain sorghum was planted with a no-till planter.

Timing of herbicide treatments also were compared: some were applied two weeks ahead of planting; others, applied immediately after planting.

Results: Acceptable weed control was achieved with both tillage systems in 1980 when grass pressure was light. Drought conditions during the summer resulted in poor grain yields, so yield comparisons between tillage systems were not possible.

Conclusions: Previous research with reduced tillage has shown herbicide effectiveness as erratic, so more research is needed before recommendations can be made.

## Evaluation of Corn Herbicides

Although corn acreage is limited in southeastern Kansas, it is an important cash and feed crop for farmers who have the land and water necessary for growing corn. Keeping the crop clean of troublesome weeds is highly important in achieving optimum yields.

Procedure: In 1980 we evaluated currently labelled corn herbicides on two soil types in Labette county.

Sutan tank-mix combinations, incorporated with a disc, gave the best overall control.

Herbicides incorporated with field cultivator were evidently too deep and gave somewhat less effective control than similar treatments applied after planting and before plants emerged.

Results: Weed control ratings for the different treatments are presented in Table 4, but yield data were not obtained because of drought conditions.

Conclusions: In many cases, proper application method and determining the optimum herbicide rate for a given soil type are essential for optimum weed control and are as important as deciding which herbicide combination to apply. When specific weed problems are encountered, be sure the weeds to be killed are listed on the label of the herbicide selected.

Table 4. Evaluation of corn herbicides, Labette County, 1980.

| Herbicide treatments | Rate a.i./a | When applied | Labette county Control, % Crab-grass | Labette county Control, % Rough pigweed | Mound Valley field Control, % Smooth pigweed |
|---|---|---|---|---|---|
| Control | - - - | | 0 | 0 | 0 |
| Sutan[+] + AAtrex nine-0 | 3.3 + 1.25 | PPI | 95 | 95 | 95 |
| Sutan[+] + Bladex-4L | 3.3 + 1.75 | PPI | 95 | 95 | 95 |
| Sutan[+] + AAtrex nine-0 | 3.3 + 1.0 + 1.5 | PPI | 95 | 95 | 95 |
| Bicep | 2.8 | Shallow Incorp | 70 | 75 | 90 |
| Bicep | 2.8 | Pre | 80 | 90 | 95 |
| Dual + Bladex-4L | 1.5 + 1.5 | Shallow Incorp | 70 | 80 | 80 |
| Dual + Bladex-4L | 1.5 + 1.5 | Pre | 80 | 80 | 90 |
| Lasso + AAtrex nine-0 | 1.75 + 1.25 | Shallow Incorp | 70 | 90 | 90 |
| Lasso + AAtrex nine-0 | 1.75 + 1.25 | Pre | 80 | 95 | 95 |
| Lasso + Bladex-4L | 1.75 + 1.50 | Shallow Incorp | 70 | 70 | 85 |
| Lasso + Bladex-4L | 1.75 + 1.5 | Pre | 80 | 85 | 90 |
| Prowl + AAtrex nine-0 | 1.5 + 1.25 | Pre | 80 | 95 | 95 |
| Prowl + Bladex-4L | 1.5 + 1.5 | Pre | 90 | 80 | 95 |
| AAtrex nine-0 + Bladex-4L | 1.25 + 1.25 | Pre | 80 | 90 | 95 |

PPI = Incorporated with a disc before planting.

PRE = Applied after planting and before corn emerged.

Shallow Incorp = incorporated with a field cultivator before planting.

## Evaluation of Herbicides in Established Alfalfa Stands

After alfalfa has been established a few years, winter annual weeds and crabgrass often invade. Controlling such problem weeds with herbicides would increase alfalfa's productivity in southeastern Kansas.

Procedure: Alfalfa herbicide treatments were applied to an established field in Neosho county in early December and early March to control winter annual weeds and crabgrass.

Results: Excellent control of several winter annual species was achieved with the herbicides tested (Table 5).

Conclusion: Applying herbicides when alfalfa is dormant in late fall or early spring effectively controlled winter annual weeds commonly found in established alfalfa fields.

Table 5. Evaluation of Alfalfa Herbicides in an Established Stand, Neosho County, 1980.

| Treatment | Rate lbs Prod/a | When applied 1/ | Control, % Winter annuals 2/ | Crabgrass 3/ |
|---|---|---|---|---|
| 1. Control | - - - | - - - | 0 | 0 |
| 2. Princep-90 DF | 1.3 | Fall | 95 | 80 |
| 3. Karmex-80W | 2.0 | Fall | 75 | 90 |
| 4. Karmex-80W | 1.0 | Spring | 30 | 85 |
| 5. Karmex-80W | 2.0 | Spring | 30 | 90 |
| 6. Kerb-50W | 2.0 | Fall | 75 | 20 |
| 7. Kerb-50W | 2.0 | Spring | 80 | 85 |
| 8. Sencor-4F | 1 pt | Fall | 95 | 20 |
| 9. Sencor-4F | 1 pt | Spring | 95 | 20 |
| 10. Sencor-4F | 2 pts | Spring | 95 | 20 |
| 11. Sinbar-80W | 1.0 | Fall | 95 | 65 |
| 12. Sinbar-80W | 1.0 | Spring | 95 | 90 |

1/ Fall application - Dec 4, 1979
Spring application - Mar 10, 1980

2/ Winter annual weeds included chickweed, henbit, wild carrot, and shepherd's purse.

3/ Crabgrass population was only on one plot.

## Soybean Variety Performance Test

Southeastern Kansas is the leading soybean-producing area in Kansas so extensive variety testing is of great benefit to producers.

Procedure: In 1980, 35 soybean varieties of commercial and university origin were planted June 23 at the Columbus field in Cherokee county.

Results: Extremely dry, hot conditions during the summer and the critical pod-filling period severely depressed soybean yields of all maturity groups. Three-year averages of the more commonly grown varieties are shown below. Complete soybean variety results are compiled in Agric Expt. Station Report of Progress 393.

| Variety | Yield, bu/a 1978-80 |
|---|---|
| Williams 79 | 19.6 |
| Crawford | 19.7 |
| Columbus | 17.7 |
| Essex | 17.6 |
| Forrest | 24.0 |
| Bedford | 21.3 |
| York | 22.5 |
| Asgrow A5618 | 20.5 |
| Hood 75 | 23.6 |

Conclusions: For the past 3 years, late summer weather has not been normal in southeastern Kansas, and yield differences among maturity groups have not been large. Under more normal conditions, Group V maturing varieties (Essex and Forrest) should perform better than earlier-maturing varieties.

## Effect of Planting Date on Yields of Early, Medium, and Late Maturity Soybeans

Soybean varieties of various maturities are planted in southeastern Kansas from mid-May until mid-July. It is important to select a variety and planting date that will give maximum yields and still fit the desired cropping sequence.

Procedure: In 1980 five soybean varieties (Williams, DeSoto, Crawford, Essex, and Forrest) were planted on four dates (May 29, June 11 and 23, and July 2) at the Columbus field.

Results: All varieties, regardless or maturity, yielded better when planted in late June or early July. Previous year's research gave similar results. Planting after mid-June allows many of the varieties to reach the critical pod-filling stage during late August and early September when temperature and moisture conditions normally are more favorable. However, longer season varieties like Forrest, also have yielded well when planted in late May and early June. Planting Forrest maturity varieties later than June in extreme southeastern Kansas delays harvest until early November.

Conclusion: Planting more than one variety of late group IV and group V maturity at several different dates improves chances of avoiding the hot, dry period as soybeans reach the critical pod-filling stage.

Table 6. Effect of planting date on soybean yield with varieties of early, medium, and late maturity, Columbus, 1980.

| Planting date | Yield, bu/a | | | | | |
|---|---|---|---|---|---|---|
| | Williams | DeSoto | Crawford | Essex | Forrest | Average |
| May 29 | 5.8 | 5.3 | 6.1 | 9.7 | 15.0 | 8.4 |
| June 11 | 7.1 | 7.1 | 9.2 | 11.1 | 13.9 | 9.7 |
| June 23 | 8.2 | 8.7 | 11.0 | 16.5 | 16.0 | 12.1 |
| July 2 | 11.4 | 10.8 | 16.0 | 17.0 | 19.0 | 14.8 |
| Average | 8.1 | 8.0 | 10.6 | 13.6 | 16.0 | |

LSD .05 values: Comparing one date with another date within a variety = 2.1 bu.
Comparing one variety with another variety within a planting date = 1.3 bu.

## Effects of Row Spacing on Soybean Yield with Varieties of Early, Medium, and Late Maturity.

In recent years planting soybeans in narrow rows has increased popularity in southeastern Kansas; better weed control with herbicides and improved planting equipment were largely responsible. Narrower rows also have been advocated as a way to boost soybean yields 5 to 15%. However, the yield benefit from narrower row spacings has not been fully researched with the longer-season varieties grown in southeastern Kansas.

Procedure: In 1980 five varieties (Elf, Williams, Crawford, Essex, and Forrest) were planted June 26 in four row spacings (7, 14, 21, and 30 inches) at the Columbus field.

Results: Varieties of later maturity, like Essex and Forrest, did not vary significantly in yield regardless of row spacing. The past four years' research have shown the same results. Varieties of earlier maturity, such as Crawford and Williams, yielded somewhat more in 7-inch than in 30-inch spacings.

Conclusions: Results to date show that longer-season varieties do not yield any higher when planted in narrower rows. However, under more favorable fall conditions, narrow row might give better response.

Table 7. Effects of row spacing on soybean yield with varieties of early, medium, and late maturity, Columbus, 1980.

| Row Spacing (in.) | Yield, bu/a | | | | | |
|---|---|---|---|---|---|---|
| | Elf | Williams | Crawford | Essex | Forrest | Average |
| 7 | 14.7 | 21.9 | 23.5 | 29.6 | 31.3 | 24.2 |
| 14 | 12.8 | 20.6 | 21.1 | 27.8 | 31.6 | 22.8 |
| 21 | 11.5 | 20.8 | 20.4 | 27.3 | 28.5 | 21.7 |
| 30 | 11.6 | 20.0 | 20.5 | 28.0 | 30.0 | 22.0 |
| Average | 12.7 | 20.8 | 21.4 | 28.2 | 30.4 | |

LSD (.05) values: Comparing variety means averaged over all row spacings = 4.0 bu.
Comparing row spacing means averaged over all varieties = 1.1 bu.

## Effects of Cropping Sequence on Soybean Yields

Soybeans are the major cash crop for many farmers in southeastern Kansas. Typically they are grown in several cropping sequences with wheat and grain sorghum, or in doublecropping systems. More information is needed to determine how different cropping sequences influence yields and net profits.

Procedure: In 1979 four cropping rotations were initiated: (1) [wheat-doublecrop soybeans]-soybeans, (2) wheat-soybeans, (3) grain sorghum-soybeans, and (4) continuous soybeans fertilized every year.

Results: Soybean yields in 1980 (*) were:

| Cropping sequence | Soybean yield, bu/a |
|---|---|
| [Wheat-doublecrop soybeans]-Soybeans* | 12.6 |
| Grain sorghum - soybeans* | 13.3 |
| Wheat - soybeans* | 12.8 |
| Soybeans - soybeans* | 10.3 |
| Treatment LSD .05 | 1.0 |

Conclusion: More studies on wheat and soybean cropping sequences are planned for 1981 to evaluate double-cropping effects of wheat and soybeans compared with full season crops, or a combination of the two with three crops in two years [wheat-doublecrop soybeans] - soybeans.

## Residual Effects of Phosphorus on Soybean Yields

Many of the soils in southeastern Kansas are low in available phosphorus. When phosphorus fertilizer is applied, part of it becomes unavailable over time so it cannot be taken up by the plant-root system. The amount of such phosphorus fixation is not fully known for the clay-pan, acid soils of southeastern Kansas.

Procedure: In 1978, we initiated a study to see if heavy, first-year applications (200 pounds $P_2O_5$ per acre) would be as effective for soybeans as 100 pounds $P_2O_5$ per acre applied every other year, or 50 pounds per acre every year. After 4 years, all plots will have received the same amount of $P_2O_5$. The two P sources used were diammonium orthophosphate (AOP, 18-46-0) and ammonium polyphosphate (APP, 15-62-0).

Results: Largely due to the dry topsoil during 1980, P applications did not significantly increase soybean yields. In both previous years annual P treatments of 50 lbs $P_2O_5$ per acre had increased yields 2 to 5 bushels per acre on this low testing soil (10 lbs of available P).

Conclusions: Where soils are testing less than 15 pounds of available P per acre, soybean yields have increased 3 to 5 bushels per acre from phosphorus fertilizer.

## Effects of Direct Phosphorus and Potassium Application on Soybean Yields

Soybeans have not responded consistently to phosphorus and potassium fertilizer applications in southeastern Kansas, especially in soils testing low to medium in available nutrients. Additional research is needed to determine under what soil conditions a fertilizer response is likely.

Procedure: For the past three years, two rates of P and K (40 and 80 lbs per acre) applied separately or in combination and two methods of application (broadcast and knifed) have been studied on several soil sites in Cherokee county.

Results: Soybean response to the different fertilizer treatments have been very small; however, abnormally dry soil conditions existed each of the past three years. With more favorable soil moisture, the root system of the soybean plant might make more efficient use of the applied fertilizer.

Conclusion: Results remain inconclusive regarding the profitability of fertilizing soybeans on soils testing in the medium fertility range.

## Effects of Primary Tillage Methods on Weed Control in Soybeans

Tillage methods have changed dramatically in recent years with chisel plows, plowing discs, off-set discs, and other types of reduced tillage implements. Compared with the moldboard plow, most of the newer implements leave more crop residue, but how they affect weed control in soybeans has not been evaluated fully in southeastern Kansas.

Procedure: In 1980 soybeans were planted where grain sorghum had been grown previously. Half of the plot area was plowed, and the other half chiseled. Two incorporated herbicide treatments and three surface-applied treatments were compared on both the plow and chisel plots.

Results: There were no significant yield differences between the plow and chisel treatments, nor were there any differences in weed pressure. At one location, where lack of rainfall prevented the herbicide applied before plants emerged from being activated, the incorporated treatments gave much better weed control. However, at another location where rainfall was not a limiting factor after planting, there were no significant differences for herbicides incorporated before planting and those applied after planting before plants emerged.

Conclusion: More research data are needed on herbicide and tillage interactions before firm conclusions are reached.

Table 8. Effects of primary tillage methods (Chisel and Plow) on soybean weed control and yield after grain sorghum.

| | | | Parsons Field | | | | | | Columbus Field | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Plow | | | Chisel | | | Plow | | Chisel | |
| | | | Control, % | | | Control, % | | | Control, % | | Control, % | |
| Herbicide | Rate a.i./A | When applid | Crab-grass | Pig-weed | Yield bu/a | Crab-grass | Pig-weed | Yield bu/a | Pig-weed | Yield bu/a | Pig-weed | Yield bu/a |
| 1. Treflan + Sencor-4L | 0.75 + 0.38 | PPI | 95 | 95 | 18.6 | 95 | 95 | 17.6 | 95 | 13.2 | 95 | 12.9 |
| 2. Prowl + Sencor-4L | 0.75 + 0.38 | PPI | 95 | 95 | 17.9 | 95 | 95 | 17.9 | 95 | 12.5 | 95 | 13.7 |
| 3. Lasso + Sencor-4L | 2.0 + 0.25 | Pre | 95 | 95 | 18.7 | 85 | 95 | 19.9 | 50 | 9.8 | 50 | 10.4 |
| 4. Dual + Sencor-4L | 1.5 + 0.25 | Pre | 95 | 95 | 17.6 | 95 | 95 | 20.0 | 50 | 10.9 | 50 | 10.8 |
| 5. Surflan + Sencor-4L | 1.0 + 0.25 | Pre | 95 | 95 | 17.9 | 85 | 95 | 18.4 | 50 | 10.4 | 50 | 9.7 |
| 6. Control (Cultivated) | - - - - - - | - - | 0 | 0 | 12.9 | 0 | 0 | 14.4 | 0 | 7.9 | 0 | 8.5 |

Parsons Field

Moderate weed pressure from crabgrass and smooth pigweed.
Date of herbicide application: PPI (June 9); Pre (June 10).
Planting date: June 10; variety - Crawford.
Rainfall: June 17 (0.67), 18 (0.71).

Columbus Field

Moderate pigweed pressure.
Date of herbicide application: PPI (June 23); Pre (June 24).
Planting date: June 24; variety - Crawford.
Rainfall: July 26 (0.50), Aug. 4 (0.60), Aug. 14 (1.15), Aug. 18 (1.25).

PPI = incorporated with a disc before planting; Pre = applied after planting before soybeans emerged.

## Soybean Herbicide Performance

When producing soybeans, it is vitally important to control weeds without injuring soybean plants. Extensive research is devoted to the performance testing of soybean herbicides and application methods.

Procedure: In 1980 several different herbicide studies were conducted on soybeans. Details of the application methods are discussed in the results section of each study.

Results: Abnormally dry conditions during the summer reduced the effectiveness of herbicides in controlling weeds. A brief summary of individual studies follows:

1) Incorporated and preemergent herbicide applications for velvetleaf control.

   Sencor and/or Lexone gave effective velvetleaf control when applied with the disc or field cultivator before planting. Applications made after planting before plants emerged resulted in poor control due to dry soil and inactivation of the herbicide. Likewise, applications of Lorox, Goal, and Modown made after planting before plants emerged were ineffective.

2) Incorporated and preemergent herbicide applications for pigweed control.

   Incorporated treatments of dinitroaline herbicides (Treflan, Tolban, Basalin, and Prowl) in combination with Sencor and/or Lexone gave good pigweed control.

3) Post-emergent applications for cocklebur, velvetleaf, and annual morning-glory control.

   Air temperatures exceeding 100 F, low relative humidity, and dry topsoil were the major factors that contributed to the very poor results obtained with all post-emerge herbicides that were applied after the soybeans and weeds had emerged. Adding crop oil did not improve broadleaf weed control. Weeds like cocklebur and velvetleaf have to be actively growing to translocate the herbicide into the plant.

4) Incorporated and post-emergent treatments for rhizome johnsongrass control.

   Incorporating Treflan, Tolban, or Basalin at the rate of 2 pounds active ingredient per acre gave 80% control of johnsongrass rhizomes and seedlings the first year applied. Several post-emerge herbicides applied after the soybeans had emerged and when johnsongrass was 12 to 18 inches tall were ineffective due to summer drought.

5) Herbicide evaluation with soybeans planted no-till in wheat stubble.

Lack of grassy and broadleaf weed pressure prevented any meaningful results. A good stand of soybeans was obtained in the wheat stubble, but nearly all soybean plants died during the hot, dry weather.

Conclusions: In 1980 where soil conditions were extremely dry, incorporated herbicides were more effective than those applied before soybeans emerged, but in more nearly normal years, the difference was less pronounced.

Where broadleaf weeds like velvetleaf, cocklebur, and moringglory are a problem, sprays should not be applied after soybeans emerge when weeds are severely drought stressed. Weeds must be actively growing for herbicides to be effective. In addition, proper timing of post-emergent herbicides is essential to control weeds.

Post-emergent treatments to control shizome johnsongrass need to be researched more in southeastern Kansas. Likewise, more information is needed with soybeans planted no-till in wheat stubble before herbicide recommendations can be made.

BEEF CATTLE RESEARCH

Lyle W. Lomas
Animal Scientist

Effect of Supplemental Protein on the Performance of Backgrounded Calves Wintered on Fescue Pasture

Cattle producers commonly face the question of how much supplemental protein to feed to grazing steers dry wintered on hay and pasture. With high interest rates and fluctuating cattle markets, overfeeding protein is economically prohibitive. Yet to economically maintain and improve winter gains, adequate supplemental protein must be provided. This study was designed to determine the level of supplemental protein needed by 500-lb steer calves wintered on mixed grass hay (fescue and bromegrass) and fescue pasture.

Procedure: Sixty-four Hereford x Angus steer calves averaging 502 lb were allotted December 19, 1979, to 8 five-acre fescue pastures of 8 steers each. Two pastures were assigned to each level of supplemental protein: .17, .34, .51 or .68 lb per head daily. All cattle were implanted initially with 36 mg Ralgro and were wintered on fescue pasture and big round bales of mixed grass hay (fescue and bromegrass) fed *ad libitum* in round slant-bar feeders. The hay contained 9.1% crude protein on a dry matter basis. Cattle on all protein levels received the same quantity supplementary energy (1.0 lb TDN/head/day), which was provided by adjusting the amount of soybean meal (51.4% crude protein on a dry matter basis) and ground milo (10.6% crude protein on a dry matter basis). Cattle were fed daily in 8-foot, round-bottom metal bunks. Initial and final weights were taken after a 16-hour shrink from feed and water. This study was terminated March 31, 1980.

Results:

Table 9. Performance of Steers on Indicated Level of Supplemental Protein - 103 days.

| Item | Supplemental protein (lb/head/day) .17 | .34 | .51 | .68 |
|---|---|---|---|---|
| No. of steers | 16 | 16 | 16 | 16 |
| Average initial wt, lb | 500 | 503 | 504 | 501 |
| Average final wt, lb | 602 | 593 | 624 | 610 |
| Average daily gain, lb | .98[a,c] | .87[a] | 1.16[b] | 1.06[b,c] |
| Average daily hay intake, lb[1] | 9.67 | 11.89 | 11.45 | 10.27 |

[1] As-fed basis.
[a,b,c] Values in the same row with different superscripts differ significantly ($P < .05$).

Feeding .51 lb of supplemental protein per head daily produced significantly higher average daily gains ($P < .05$) than .17 or .34 lb of supplemental protein and .68 lb per head daily resulted in no further improvement ($P > .20$) over the .51 lb level (Table 9 ).

Conclusion: Approximately one-half lb of supplemental protein is needed by 500-lb steer calves wintering on fescue pasture and grass hay (fescue and brome-grass). The .51-lb-per-day rate produced highest animal performance and lowest cost of gain in this study.

## Effect of Alfalfa Creep on the Performance of Fall-dropped Suckling Calves

The milking ability of a beef cow and the quantity and quality of pasture or other feed available to her and her calf largely determine the ability of her calf to reach its genetic potential at weaning time. After a beef calf is 90 days old, its dam's milk usually supplies only about half the nutrients it needs for maxium growth. So abundant high quality feed usually must be provided in a creep for the calf to attain maximum growth. This is particularly important for fall-dropped calves because less high quality forage is available during winter. Grain mixtures have been used in creep rations, but high grain prices now often make that practice unprofitable, so more economical creep rations need to be developed. This study examined the performance of fall-dropped calves creep fed alfalfa hay.

Procedure: Sixteen fall dropped Hereford and Hereford x Angus calves (10 heifers and 6 steers) were equally divided November 19, 1979, into 2 groups by weight, sex and breed. One group received high quality, long form alfalfa hay *ad libitum* in a creep; the other group received no creep feed. The alfalfa hay contained 17.0% crude protein on a dry matter basis. Each group of calves and their respective dams were wintered on 15-acre fescue pastures and were fed big round bales of mixed grass hay *ad libitum* in round slant-bar feeders. All calves were implanted with 36 mg Ralgro at the beginning of the study. All calves were weaned May 2, 1980, when they were approximately 7 months old.

Results:

Table 10. Effect of Creep Feeding Alfalfa Hay on Cattle Performance - 165 days

| Item | No creep | Alfalfa creep |
|---|---|---|
| No. of calves | 8 | 8 |
| Average initial calf wt., lb | 106 | 113 |
| Average final calf wt., lb | 362[a] | 419[b] |
| Average daily calf gain, lb | 1.55[a] | 1.85[b] |
| Average daily creep feed intake, lb[1] | - - - | 1.62 |
| Creep feed required for each additional lb calf gain[1] | - - - | 5.35 |
| Average initial cow wt., lb | 1086 | 1105 |
| Average final cow wt., lb | 1111 | 1142 |
| Average cow gain, lb | 25 | 37 |
| Average daily grass hay intake per cow-calf pair, lb[1] | 21.70 | 22.28 |

[1] As-fed basis.

[a,b] Values in the same row with different superscripts differ significantly ($P < .05$)

Daily gain by calves that received alfalfa hay was 19.4% higher ($P < .05$) (50 lb. more in 165 days) than gain by calves that received no creep. For each additional lb of gain the creep-fed calves required 5.35 lb of alfalfa hay. Cow weights and intakes of grass hay between the two treatments were similar.

Conclusions: Creep feeding alfalfa hay effectively and economically increased weaning weights of fall-dropped calves without adding extra condition.

## Effect of Level of Milo and Monensin Supplementation on Rate of Gain of Steers Grazing Brome Pasture

With high interest rates and fluctuating cattle markets, cattle producers must decide whether or not to supplement grazing steers with grain. Cool season grasses like fescue and smooth brome produce well during spring and again in fall, but not during the summer grazing period. A 1979 study established that energy supplementation at 2 to 4 lb of rolled milo per head daily optimized efficiency of grain utilization by 525-lb Hereford steers grazing brome pasture from May 7 to September 25. Another study described below was conducted during the summer of 1980 to determine the effect of level of milo and monensin supplementation on rate of gain of steers grazing brome pasture.

Procedure: Sixty-four Hereford x Angus yearling steers averaging 658 lb were allotted May 8, 1980, to 8 five-acre smooth bromegrass pastures of 8 steers each. Two levels of milo ( 2 or 3 lb per head daily) and 2 levels of monensin( 0 or 200 mg per head daily) were evaluated in the following combination: 1) 2 lb milo and 0 mg monensin; 2) 2 lb milo and 200 mg monensin; 3) 3 lb milo and 0 mg monensin; and 4) 3 lb milo and 200 mg monensin. All cattle were implanted initially with 36 mg Ralgro. Brome hay was provided *ad libitum* to all cattle beginning July 3 when pastures became short. Cattle were fed grain daily in 8-foot, round-bottom metal bunks. Initial and final weights were taken after the 16 hour shrink from feed and water. This study was terminiated August 19, 1980.

Results: The results are presented in Table 11.

Table 11. Effect of Level of Milo and Monensin on Cattle Performance - 103 days

| | Level of Milo (lb per head daily) | | | |
|---|---|---|---|---|
| | 2 | | 3 | |
| | Level of monensin (mg per head daily) | | Level of monensin (mg per head daily) | |
| Item | 0 | 200 | 0 | 200 |
| No of steers | 16 | 16 | 16 | 16 |
| Average initial wt, lb | 662 | 655 | 656 | 658 |
| Average final wt, lb | 764 | 773 | 756 | 786 |
| Average daily gain, lb | 1.00 | 1.14 | .98 | 1.24 |
| Average daily hay intake, lb[1] | 15.7 | 15.8 | 15.9 | 16.2 |

[1]As-fed hay intake during last 47 days of study.

The data were analyzed by milo level and monensin level and these results are listed in Tables 12 and 13, respectively.

Table 12. Effect of Level of Milo on Cattle Performance - 103 days

| Item | Level of milo (lb per head daily) | |
|---|---|---|
| | 2 | 3 |
| No. of steers | 32 | 32 |
| Average initial wt, lb | 658 | 657 |
| Average final wt, lb | 768 | 771 |
| Average daily gain, lb | 1.07 | 1.11 |
| Average daily hay intake, lb[1] | 15.7 | 16.0 |

[1] As-fed hay intake during last 47 days of study.

[a,b] Values in the same row with different superscripts differ significantly ($P < .05$).

Table 13. Effect of Monensin on Cattle Performance - 103 days

| Item | Level of Monensin (mg per head daily) | |
|---|---|---|
| | 0 | 200 |
| No. of steers | 32 | 32 |
| Average initial wt, lb | 659 | 656 |
| Average final wt, lb | 760 | 779 |
| Average daily gain, lb | .99[a] | 1.19[b] |
| Average daily hay intake, lb[1] | 15.8 | 16.0 |

[1] As-fed hay intake during last 47 days of study.

[a,b] Values in the same row with different superscripts differ significantly ($P < .01$).

There was no significant difference ($P > .20$) in average daily gain between feeding 2 or 3 lbs of rolled milo per head daily. However, feeding 200 ppm monensin per head daily resulted in a 20.2% increase in average daily gain ($P < .01$).

Conclusions: Feeding 200 mg monensin along with 2 lbs of rolled milo per head daily was the most profitable combination evaluated in this study for supplementing yearling steers summer grazed on cool season grasses.

## OTHER RESEARCH

Two projects were completed using products not yet approved for use with beef cattle by the Food and Drug Administration. Brief summaries of these studies are listed below.

Implants for Grazing Cattle. A study was conducted to compare rate of gain in grazing steers implanted once with Ralgro or an experimental long lasting removable implant with an effective life of 200 days. Both implants significantly ($P < .05$) increased average daily gain over the non-implanted control group, but there was no significant difference ($P > .20$) in daily gain between the two implants in this 200-day study.

An Experimental Antibiotic and Ralgro For Finishing Cattle. An antibiotic feed additive that is not yet approved for use with beef cattle was evaluated in combination with Ralgro in a finishing study. Ralgro significantly ($P < .05$) improved average daily gain while the experimental antibiotic decreased feed intake and significantly ($P < .01$) improved feed conversion with no effect on gains. The two products in combination further improved feed efficiency beyond that obtained with the experimental antibiotic alone.

# FORAGE CROPS RESEARCH

J. L. Moyer
Forage Agronomist

## Performance of Alfalfa Varieties in Southeastern Kansas

Interest in alfalfa production has been renewed with declining alfalfa weevil. This test is to help answer the question, "What variety should I plant?" when one establishes alfalfa.

Procedure: Twenty-four alfalfa varieties were seeded at 12 lb/a in spring, 1978. Benefin (Balan) at 1 1/2 lb a.i./a was applied before alfalfa emerged and 400 lb/a of 6-24-24 preplant fertilizer were used. Seven varieties originated at Federal and State experiment stations; the other 17 were from six seed companies.

In 1979, 200 lb/a of 6-24-24 was applied after the first cutting, and grasshoppers were sprayed with Furadan between the second and third cuttings. Another 200 lb/a of 6-24-24 were applied after the last cutting. The 1980 crop was sprayed with dimethoate in April to control aphids. Young grasshoppers were sprayed between cuttings with Sevin.

Results: Drought limited alfalfa production to two cuttings in 1980 (Table 14). The first cutting produced an average of 1.7 tons/a: the second, only 0.73 tons. Two varieties yielded significantly above the average of cut 1, one in the second cutting, and two were above average in total yield. Yields in 1979 averaged 4.76 tons/a from four cuttings, with no significant differences among varieties. Three-year production totals ranged from 7.22 to 8.21 tons/a, and averaged 7.82 tons/a.

Conclusion: Data from three full crop years should be obtained before conclusions are drawn. So far three varieties have produced more than 8 tons/a, and seem more promising than the four which have yielded less than 7.5 tons/a (Table 14).

Table 14. Alfalfa Forage Yields for the Variety Test seeded April 25, 1978 at Mound Valley.

| Variety | Source | Yield (tons/a @12% moisture) 1980 Cut 1 | Cut 2 | Total 1/ | 1979 2/ | 1978 3/ | 3-yr total |
|---|---|---|---|---|---|---|---|
| Thor | Northrup-King | 1.88 | 0.77 | 2.64 | 4.84 | 0.73 | 8.21 |
| 130 | DeKalb | 1.82 | 0.82 | 2.64 | 4.93 | 0.61 | 8.18 |
| Olympic | NAPB | 1.68 | 0.89 | 2.57 | 4.57 | 0.84 | 7.98 |
| 531 | Pioneer | 1.90 | 0.66 | 2.56 | 4.58 | 0.62 | 7.76 |
| Apollo | NAPB | 1.72 | 0.83 | 2.55 | 4.82 | 0.63 | 8.00 |
| Saranac | Cornell | 1.74 | 0.78 | 2.52 | 4.68 | 0.66 | 7.86 |
| 5510A | Land-O-Lakes | 1.72 | 0.78 | 2.51 | 4.76 | 0.60 | 7.87 |
| Pacer | Land-O-Lakes | 1.71 | 0.76 | 2.47 | 5.10 | 0.55 | 8.12 |
| Atlas | NAPB | 1.74 | 0.72 | 2.46 | 4.82 | 0.61 | 7.89 |
| Riley | KSU | 1.72 | 0.72 | 2.44 | 4.74 | 0.53 | 7.71 |
| Arc | USDA | 1.70 | 0.72 | 2.43 | 4.68 | 0.65 | 7.76 |
| Vernal | Univ, Wisc | 1.75 | 0.68 | 2.43 | 4.80 | 0.63 | 7.86 |
| Tempo | NC+ | 1.70 | 0.72 | 2.42 | 4.62 | 0.75 | 7.79 |
| Gladiator | Northrup-King | 1.67 | 0.75 | 2.42 | 4.82 | 0.70 | 7.94 |
| Sunrise | NC+ | 1.68 | 0.72 | 2.40 | 4.89 | 0.68 | 7.97 |
| 545 | Pioneer | 1.67 | 0.73 | 2.40 | 4.70 | 0.64 | 7.74 |
| 120 | DeKalb | 1.73 | 0.67 | 2.40 | 4.84 | 0.68 | 7.92 |
| Weevlchek | NC+ | 1.64 | 0.73 | 2.37 | 4.81 | 0.54 | 7.72 |
| Hi-Phy | NC+ | 1.64 | 0.72 | 2.36 | 4.85 | 0.58 | 7.79 |
| 521 | Pioneer | 1.69 | 0.66 | 2.35 | 4.69 | 0.44 | 7.48 |
| Vanguard | NAPB | 1.62 | 0.72 | 2.34 | 5.00 | 0.63 | 7.97 |
| Kanza | KSU | 1.62 | 0.69 | 2.31 | 4.48 | 0.43 | 7.22 |
| Cody | KSU | 1.58 | 0.66 | 2.24 | 4.56 | 0.66 | 7.46 |
| Baker | USDA | 1.61 | 0.62 | 2.23 | 4.62 | 0.54 | 7.39 |
| Average | | 1.70 | 0.73 | 2.43 | 4.76 | 0.62 | 7.82 |
| LSD | | 0.16 | 0.13 | 0.19 | NS | 0.16 | - - |

1/ Only two cuttings were obtained because of drought. Average total yields may not equal sum of cut 1 and cut 2 yields because of rounding the means. Cut 1 was taken May 8, and cut 2 June 25.

2/ Total yields from four cuttings taken May 11, June 15, July 19, and August 21.

3/ Yield of a single cutting taken June 28 of the seeding year. Drought prevented regrowth. Average of the three replications.

## Knifed or Broadcast Fertilizer Applications on Tall Fescue

J. L. Moyer and R. E. Lamond

Fertility of old fescue is generally low beneath the top few inches of soil. The situation has developed as fescue removed nutrients from the root zone and fertilizer was top-dressed on the surface. Studies were begun in 1979 to see if placing fertilizer in the root zone increased yield, quality, or fertilizer uptake compared with surface-broadcasting.

Procedure: In 1979, liquid fertilizer was applied on the Terry Weidert farm in Labette county by broadcasting through flat-spray nozzles, "dribble" on the surface from the boom, or "knifed" 6 to 8 inches deep through an injection tube behind narrow shanks 15 inches apart. Rates were 50, 100, or 150 lb N/a as urea-ammonium nitrate (UAN), and 0 or 40 lb $P_2O_5$-$K_2O$/a. The soil tested 12 lb/a available P and 85 lb/a exchangeable K, both in the "low" range.

The same location was used in 1980, but different rates and carriers of nitrogen fertilizer were used to compare broadcast and knifed applications. The same rates of N and P-K were used with UAN, but anhydrous ammonia knifed into the soil replaced "dribble" treatments.

Another Weidert farm used in 1980 in Neosho county got liquid UAN, 10-34-0, and 0-0-10 at 12, 100, or 150 lb N/a, 0 or 40 lb $P_2O_5$/a, and 0 or 40 lb $K_2O$/a by knifed or broadcast methods. This site was also low in available P and K.

Results: Detailed reports of these experiments are in the Kansas Fertilizer Research Reports of Progress 372 (1979) and 389 (1980). Both 1979 and 1980 experiments at the Labette county location showed significant yield and crude protein (%N x 6.25) responses to N, and to P-K fertilization. Yield and protein responses to N were even greater at the Neosho county location. Since P and K applications were separate there, we found forage yield and P content responses to added P, and to added K in the presence of P.

Application method affected forage yield and composition (see Table 15 ). Knifing UAN produced significantly more forage than broadcasting the same material in both 1980 experiments, and crude protein content was significantly increased by knifing in all experiments. Knifed ammonia was intermediate in both yield and crude protein between knifed and broadcast UAN in Labette county in 1980.

Conclusion: Knifing N and P fertilizer increased tall fescue hay yield by about 400 lb/a, and enhanced hay quality over surface broadcast applications. In addition, fertilizer efficiency was increased by knifing. More work is needed to predict conditions necessary for an economic crop response to knifed fertilizer applications.

Table 15. Effects of Fertilizer Application Methods on 1980 Tall Fescue Production and Composition.

| Method | | Forage yield, lb/a @12.5% moisture | Forage composition %N | %P | %K |
|---|---|---|---|---|---|
| | | Labette county, 1980 1/ | | | |
| UAN Broadcast | | 1070 | 2.12 | 0.24 | 1.66 |
| UAN Knifed | | 1480 | 2.52 | 0.24 | 1.78 |
| $NH_3$ Knifed | | 1150 | 2.29 | 0.24 | 1.88 |
| | LSD .05 | 130 | 0.13 | NS | 0.11 |
| | | Neosho county, 1980 2/ | | | |
| Broadcast | | 3310 | 1.58 | 0.15 | 1.51 |
| Knifed | | 3710 | 1.90 | 0.15 | 1.45 |
| | LSD .05 | 280 | 0.08 | NS | NS |

1/ Means of 50, 100, and 150 lb N/a, and 0 and 40 lb/a $P_2O_5$-$K_2O$ rates.

2/ Means of 12, 100, and 150 lb N/a, 0 and 40 lb $P_2O_5$/a, and 0 and 40 lb $K_2O$/a rates.

## Effects of Ag Lime Application on Yield, Quality, and Fertilizer Response of Established Tall Fescue and Interseeded Red Clover

Forage legumes in tall fescue can increase forage quality and reduce production costs. But many tall fescue meadows and pastures require lime to establish and produce legumes. A 6-year study funded by the Kansas Limestone Association, was started in November, 1979, to evaluate effects of lime on yield, quality, and fertilizer response by tall fescue interseeded with red clover. The 1980 drought confounded results, but mechanical renovation increased protein content of fescue and decreased yields except where lime was applied.

Table 16. Forage production and composition of tall fescue in 1980 as affected by lime and mechanical renovation

| Treatment | | Forage | | | |
|---|---|---|---|---|---|
| Lime Rate, (Tons E.C.C./a) | Reno-vation | Yield, tons/a @ | %N | %P | %K |
| 0 | - | 1.41 | 0.88 | 0.20 | 1.27 |
| | + | 1.02 | 0.97 | 0.15 | 1.21 |
| 1.25 | - | 1.13 | 0.80 | 0.15 | 1.34 |
| | + | 1.03 | 1.04 | 0.15 | 1.36 |
| 2.50 | - | 1.27 | 0.81 | 0.15 | 1.35 |
| | + | 1.47 | 1.07 | 0.16 | 1.09 |
| LSD | | 0.35 | NS | NS | NS |

## Burning and Fertilizing Native Meadows in Southeastern Kansas

J. L. Moyer, Larry Tieman, John Meisenheimer

Native meadows produce a lot of the forage in southeastern Kansas. But native hay yields are relatively low, and fixed costs on the land increase. Fertilizing can increase returns but it helps weeds enter a meadow.

These experiments were to learn if judicious use of fertilizer, along with burning or other weed control methods, could increase forage production and quality in a native meadow without increasing weeds. At Big Hill, on land managed by the Kansas Forestry, Fish and Game Commission, four years of treatment are being followed by two years of observing residual effects.

Procedure: Treatments, begun in 1976, consisted of burned and unburned blocks with 8 fertility levels - a control, and 30 lb N/a with 0, 10, or 30 lb/a of phosphate and/or potash applied annually through 1979. No treatments were imposed in 1980 so residual effects could be measured on forage yield, crude protein, and botanical composition of the hay, and pH, P, and K levels in the soil.

A new weed control experiment was begun at Parsons in 1980. Three fertilization treatments, control, 24-24-24 and 48-48-48, were applied to burned or unburned plots. Forage yields were taken.

Results: Yield increases were obtained at Big Hill in 1980 from some previously burned, fertilized plots. Control (no fertilizer) treatments, both burned and unburned averaged 1.24 ton/a @12% moisture, while burned plots previously receiving 30-30-30 produced 1.70 ton/a. Nitrogen-only treatments produced no carryover yield response on unburned plots, and no significant response on burned plots.

Crude protein of forage in 1980 was higher in unburned than in previously burned plots, opposite from yields. The same trend appeared in the residual fertilizer responses, that is, the lower-yielding treatments were higher in protein than the high-yielding plots.

Available soil P was higher in plots that had received 30 lb/a of phosphate than in any other plots. Burning made little difference in available P content. Available soil K was significantly higher on burned plots that had received 30-0-10 than in any other plots. Burned plots generally had higher available soil K than did unburned plots.

Burning increased warm-season grasses before 1980 but fertilizing caused few, if any, changes.

At Parsons burning reduced yields 30%, while fertilizing with 24-24-24 increased yields 14%, and 48-48-48 increased yields 43% over the control's (1.02 ton/a).

Conclusions: Residual effects of fertilizing and burning remained in 1980, after 1976-79 treatments. Burning and fertilizing generally decreased forage protein content where yields were increased. The 1980 burning and fertilizing showed yield increases from fertilizing but yield decreases from burning.

## Nitrate and Prussic Acid in Drought-stressed Sorghums, 1980

J. L. Moyer and Lyle Lomas

The summer of 1980 was characterized by one of the most severe droughts in southeastern Kansas records. Such stress causes nitrates to accumulate in many summer crops, and sorghums often increase the prussic acid producing compounds in their tissues. Either compound can become toxic to livestock, and death losses were reported in southeastern Kansas from animals eating drought-stricken summer forage.

Toxic response to nitrate or prussic acid is a complex interaction of diet and animal condition. The KSU Cooperative Extension Service considers feeds generally safe if nitrate concentrations are below 5,000 ppm and prussic acid, below 100 ppm. More than 9,000 ppm of nitrate or 200 ppm of prussic acid are considered toxic.

We sampled and tested many of our forages at Parsons and Mound Valley in 1980 to study the safety of various forages, sampling variations among fields, and seasonal effects on postharvest changes in concentrations of nitrate and prussic acid. Usually we could not replicate samplings to accurately estimate uncontrolled variation, so our data should be interpreted cautiously.

Procedure: Samples were assayed by a commercial laboratory. Results were reported as ppm nitrate and ppm prussic acid (HCN) on a dry matter basis. Samples sent "fresh" or green were placed on ice when collected, and either frozen until shipped or shipped directly by bus in sealed plastic bags to arrive in about 16 hrs. Dried samples were either cured hay or sampled standing then dried in an oven at about 160 F for at least 24 hours.

Whole plants were cut, chopped, and sampled, or hay was randomly sampled to represent proportions of all above-ground plant parts. A 36-inch probe one inch in diameter was used to remove several cores from big round bales.

Results:

Sampling Factors

Fresh samples shipped for assay seemed to contain less nitrate and prussic acid than samples dried then shipped (see Table 17 ). Such changes may be greater than appear here because field-curing also allows some reductions, particularly in prussic acid.

Table 17. Nitrate, prussic acid (on dry basis), and moisture content of sorghum-sudangrass cut August 22 and either fresh-frozen or allowed to field-cure three days.

| Treatment | Moisture % | Nitrate ppm | HCN ppm |
|---|---|---|---|
| Fresh-cut frozen | 86 | 17,200 | 390 |
| Field-cured | 18 | 24,500 | 780 |

Variation in toxic compounds among plants of the same variety in the same field was observed. Two five-acre fields of forage sorghum of different maturities, DeKalb hybrids FS4A+ and FS25A+, planted two weeks apart had similar 3-plant averages of more than 10,000 ppm nitrate July 25, but nitrate varied from 8,000-12,000 ppm among individual plants within each field. Plants of a hybrid grain sorghum averaged 1600 ppm nitrate, but ranged from 800 to 2700 ppm.

Much of the plant-to-plant variation could be attributed to differences in plant condition. A prematurely dead corn plant sampled July 25 had 8800 ppm nitrate, while a green plant in the same field had 300 ppm nitrate.

## Seasonal Effects

Seasonal differences in amounts of nitrate and prussic acid of field-grown sorghums were observed. The day after the July 25 sampling a 1.07-inch rain was received at Mound Valley, so forage sorghums were re-sampled July 28. Nitrate content apparently declined slightly from 10,000+ ppm July 25 to less than 8,000 ppm. But prussic acid content, high July 25 (more than 300 ppm), apparently increased to more than 500 ppm.

Sorghums generally declined in both nitrate and prussic acid contents by fall (Table 18 ). Silage sorghum at Mound Valley showed the same trend between July 28 and October 14, declining by about 2/3 in nitrate and 1/2 in prussic acid content.

Table 18. Nitrate and prussic acid contents of pastures at Parsons during 1980. Hybrid sudan was Northrup-King Trudan 8 and the forage sorghum was Golden Harvest Regro. The first killing frost was October 29.

| Sample | Nitrate, ppm. | | | Prussic acid, ppm. | | |
|---|---|---|---|---|---|---|
| | 7/28 | 8/22 | 10/29 | 7/28 | 8/22 | 10/29 |
| Hybrid sudan | 800 | | 1500 | 360 | | 110 |
| Sorghum-sudan | 1900 | 24,500 | 4000 | 1240 | 780 | 120 |

Hay samples cut in summer changed little in nitrate or prussic acid contents by fall (Table 19 ). Prussic acid content declined ( 50%) after hay was made into big round bales, while nitrate did not decline by October.

Table 19. Nitrate and prussic acid contents (dry basis) and moisture in sorghum-sudan hay sampled at indicated dates.

| Sample | Date | Nitrate ppm | Prussic Acid, ppm | Moisture % |
|---|---|---|---|---|
| Windrow | 8/25 | 24,500 | 780 | 18 |
| Big bale | 9/9 | 24,200 | 610 | 14 |
| Big bale | 10/9 | 23,800 | 280 | 13 |

## Effect of Sorghum Type

Sorghum types differed in concentrations of toxic compounds at a given time (Table 20 ), partly because the types were at different stages of maturity, especially for nitrate content. Generally, sudan seemed the safest type both July 28 and in October (Table 18 ). Of the types tested, silage-type sorghums appeared most dangerous in midsummer.

Table 20. Nitrate and prussic acid contents (ppm) of sorghum types sampled July 28, 1980.

| Sorghum type | Nitrate | Prussic Acid |
|---|---|---|
| Forage sorghum | 7400 | 500 |
| Grain sorghum | 2000 | 170 |
| Sorghum-sudan hybrid | 1900 | 1240 |
| Hybrid sudan | 800 | 360 |

Conclusions: Several general observations can be made from these data, most of which are verifiable from other reports. In sampling nitrate, and especially prussic acid, we found:

1) Toxin changes in samples, especially green samples, during storage and shipment were often substantial. This means one should stabilize samples other than hay before shipment, probably by at least partial drying, and then minimize storage time. One must then know moisture contents to estimate as-fed levels.

2) Plant-to-plant variation was observed, due mostly to condition of individual plants. If one samples a standing crop, plants in various conditions should be sampled in their approximate proportion in the field.

Levels of the two toxins were affected by several things:

1) Sudan was safest for sorghum types, forage sorghums most dangerous, and sorghum-sudan and grain sorghum were intermediate.

2) Toxins were highest in mid-to-late summer and declined in surviving plants during fall.

3) Nitrate content was more stable after cutting and during hay storage than was prussic acid, but both declined somewhat during processing.

4) Plant recovery from drought tended to reduce nitrate concentration, but increase prussic acid.

## OTHER FORAGE RESEARCH

The following projects are underway, but only preliminary results have been obtained.

Method and Frequency of P and K Fertilization on Alfalfa. Single and annual fertilizer applications by knifing or broadcasting were begun in August, 1979. The two cuttings taken in 1980 showed no differences between treatments.

Warm-season Grass Observation Nursery. Forty-five accessions of warm-season grasses, including 27 Old World bluestems, were established in spaced plantings in 1979, and evaluated for growth, regrowth, winter survival, and spring recovery. Several Old World bluestems rivaled the less palatable switchgrasses and Indiangrasses in production and outproduced the native bluestems.

Bermudagrass Variety Performance. Thirteen varieties were established in 1980, nine from sprigs and four from seed. Rate of spread was recorded, and several covered the plot by summer's end. One particularly aggressive line had to be hand-weeded from neighboring plots.

Cow-calf Performance on Tall Fescue and Red Clover-Interseeded Pastures. Four of eight 5-acre fescue pastures were fertilized with 0-40-40, limed, and interseeded with 17 lb/a of coated 'Kenstar' red clover. The other four were fertilized as usual (80-40-40 in spring, 50 lb N in August). Pasture records of animals carried were kept for each pasture, but red clover seedlings died from drought. Reseeding will be performed spring, 1980.

Birdsfoot Trefoil Performance Test. Ten cultivars established in spring, 1980, grew too little for yield determination. All appeared in excellent condition for winter, and will be harvested in succeeding years.

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## Effects of N and P Rates and Application Methods on Winter Wheat

Purpose: Many soils in southeastern Kansas respond to P application. The rising cost of P fertilizer increases interest in getting the highest efficiency possible from applied P.

Procedure: This study was established to compare methods of applying P and P rates of 30, 60, and 90 lb/a for winter wheat. Methods of P application were dual-knifed (simultaneously injecting $NH_3$ and 10-34-0 eight inches deep on 15-inch centers), broadcast, and banding with the drill. The study was established on an area that had only 4 lb/a available phosphorus. N rate was constant at 75 lbs N/ a.

Results: Wheat yield response to added P was phenomenal (Table 21 ), increasing from 6 bu/a with no $P_2O_5$/a added to nearly 52 bu/a with 90 lb $P_2O_5$/a. Broadcast P gave significantly lower yields than either dual-knifed or banded P.

Conclusions: This work shows that P fertilization effectively increases yields where soil P level is low; 30 pounds of $P_2O_5$ per acre can produce an additional 32 bushels per acre of wheat on P-limiting soils. If $P_2O_5$ costs $0.28 per pound and wheat is $4.00 per bushel, a return of $128 per acre can be achieved from an $8.40 per acre investment. These results also show that P fertilizer efficiency can be increased by either banding or dual-knifing. Both of these methods place the P in concentrated zones, which allows less P fixation.

Table 21. Effects of N and P Rates and Methods on Winter Wheat

| N | $P_2O_5$ | P Method | Grain yield bu/a @12.5% | Leaf composition %N | Leaf composition %P | Grain protein % |
|---|---|---|---|---|---|---|
| lbs/a | | | | | | |
| 0 | 0 | - - - | 6.7 | 3.08 | .14 | 13.3 |
| 75 1/ | 0 | - - - | 6.4 | 3.23 | .15 | 14.2 |
| 75 | 30 | Dual-knifed 2/ | 36.1 | 2.74 | .15 | 12.7 |
| 75 | 60 | " | 50.3 | 3.26 | .20 | 10.6 |
| 75 | 90 | " | 52.7 | 2.80 | .22 | 10.2 |
| 75 | 30 | Broadcast 3/ | 33.0 | 2.75 | .15 | 12.3 |
| 75 | 60 | " | 48.0 | 2.83 | .22 | 9.9 |
| 75 | 90 | " | 50.5 | 2.68 | .25 | 9.4 |
| 75 | 30 | Banded 4/ | 43.6 | 2.67 | .17 | 11.0 |
| 75 | 60 | " | 47.0 | 2.53 | .18 | 9.7 |
| 75 | 90 | " | 52.5 | 3.09 | .25 | 9.0 |
| Treatment LSD (.05) | | | 4.0 | NS | .04 | 1.6 |
| Means: | | | | | | |
| $P_2O_5$ rate, lbs/a | | 30 | 37.6 | 2.74 | .16 | 12.0 |
| | | 60 | 48.4 | 2.85 | .20 | 10.1 |
| | | 90 | 51.9 | 2.91 | .24 | 9.6 |
| LSD (.05) | | LSD (.05) | 2.6 | NS | .02 | .5 |
| P Method | | Dual-knifed | 46.4 | 2.93 | .19 | 11.2 |
| | | Broadcast | 43.8 | 2.80 | .20 | 10.5 |
| | | Banded | 47.7 | 2.76 | .20 | 9.9 |
| | | LSD (.05) | 2.6 | NS | NS | .5 |

1/ All N applied as $NH_3$ preplant, except N in P carriers.

2/ P as 10-34-0 applied with $NH_3$.

3/ P as 10-34-0 applied preplant through flat-spray nozzles.

4/ P as 18-46-0 applied with drill at planting time.

## Evaluations of Fertility-Tillage Management Systems

Purpose: Interest in reduced or no-tillage systems is increasing, so research is needed to determine if the systems are adaptable to southeastern Kansas. Research is also needed to see if fertility management needs to be changed under these systems.

Procedure: Work was continued in 1980 at two sites to compare conventional, reduced, and no-tillage systems. Several fertility management variables were included.

Results: Grain sorghum yields in 1980 were severely reduced by a season-long drought. Even with depressed yields, some trends were noted. The no-till system gave the lowest average yields, while reduced and conventional systems were equal. Fertility management was important. Knifing in N, P and K on the conventional and reduced systems generally resulted in higher yields than broadcast applications. The surface-applied nutrients became positionally unavailable during the dry summer. Applied N efficiency and recovery were poor on the no-till systems when UAN was the N source.

Conclusions: To date this work shows that reduced tillage systems work well in southeastern Kansas, while no-tillage systems probably sacrifice yields. Fertility management is critical under reduced or no-till systems. This work will be continued.

## Effects of Primary Tillage Methods on Soybean Yields

Purpose: Primary tillage methods used for soybeans in southeast Kansas vary widely. Many producers still use moldboard plows as their primary tillage tool.

Procedure: This study was established at two locations in 1980 to compare different primary tillage methods for soybean production. The moldboard plow, chisel, disk, soil saver, and no-till were compared.

Results: 1980 results showed no significant yield effects due to tillage used. In fact, the no-till method gave the highest yields at the Parsons Field. This work will be continued in 1981.

Conclusions: More work is needed to see if primary tillage method affects soybean yields in southeastern Kansas.

## Effects of N, P, and K Rates and Application Methods on Grain Sorghum Yields

Purpose: Because grain sorghum is an important crop in southeastern Kansas this research compares fertilizer rates and methods of application.

Procedure: This study was continued in 1980 on the Parsons Field, which has 22 pounds of available P per acre and 130 pounds of available K per acre. N rates used were 0, 50, 100, and 150 lbs N/A as $NH_3$. P-K rates were 0 and 50 pounds of $P_2O_5$ and $K_2O$ per acre. The P and K were applied , broadcast and knifed, as potassium tripolyphosphate (0-26-25) liquid. When knifed, P and K were applied simultaneously with the $NH_3$ 8 inches deep on 15-inch centers.

Results: 1980 yields were severely reduced by drought, and probably limited fertilizer response. The only significant yield increase in 1980 was from applied N fertilizer.

Conclusion: Summarizing the 1979 and 1980 data, it is clear we can expect a good yield response to applied N and that 100 lb N/A is probably near the economic optimum N rate. Also, we can expect a response to P-K even on soils with as much as 22 lb of available P and 130 lb of available K shown by soil tests. Knifing P-K gave the highest yields both years, but not significantly higher than broadcast applications.

## Effects of N, P, and K Rates and Application Methods on Soybean Yields

Purpose: Soybean response to fertilization in southeast Kansas has been inconsistent. Response is dictated by soil type, levels of available nutrients in the soil and by weather, so research is needed to determine when and where response will be likely.

Procedure: Work was begun in 1979 and continued in 1980 to evaluate soybean response to fertilization and placement of fertilizer. P-K were knifed preplant in at rates of 30, 60, and 90 lbs/a of $P_2O_5$ and $K_2O$. Potassium tripolyphosphate (0-26-25) liquid fertilizer was used to facilitate knifing in the P and K.

Results: 1980 yields were low due to the hot, dry summer, so neither fertilization or its placement significantly affected yields.

Conclusions: Results to date have not been consistent. Poor environmental conditions at critical growth stages have limited yields and fertilizer response.

## Effects of P Rates and Application Methods on Irrigated Corn Yields

Purpose: Southeastern Kansas now has an estimated 25,000 acres of irrigated field crops, mostly corn. Due to the soil types of this area, research is needed to find optimum fertility rates for irrigated corn.

Procedure: This irrigated corn work was begun in 1980. $P_2O_5$ rates used were 40, 80, 120, and 160 lbs $P_2O_5$/a either broadcast or knifed. The knifed P was injected 8 inches deep on 15-inch centers. P was supplied as 10-34-0; N, as $NH_3$ to a constant rate of 240 lbs N/a. The corn was sprinkler irrigated from a pit. Scheduling was by water depletion using 12-and 24-inch tensiometers. The site was low in available P.

Results: Yields were low in 1980 because of extremely high temperatures during pollination so kernel set was poor. Even with the low yields, the applied P significantly increased yields. Knifed P produced significantly higher yields than broadcast P (Table 22 ).

Conclusions: More work is needed to determine optimum P fertilizer rates for irrigated corn in southeast Kansas.

Table 22. Effects of P Rates and Methods on the Yield of Irrigated Corn

| Lbs/a $P_2O_5$ | Method of Application | Parsons field, Labette co. Grain yield bu/a | Tissue analysis %N | %P | %K |
|---|---|---|---|---|---|
| 0 | - - - - - | 75 | 2.93 | .29 | 1.93 |
| 40 | Broadcast | 81 | 2.79 | .29 | 2.08 |
| 80 | " | 82 | 2.85 | .30 | 2.06 |
| 120 | " | 82 | 2.82 | .30 | 2.15 |
| 160 | " | 83 | 2.75 | .31 | 2.05 |
| 40 | Knifed | 84 | 2.67 | .29 | 1.95 |
| 80 | " | 91 | 2.79 | .29 | 2.08 |
| 120 | " | 93 | 2.99 | .31 | 1.97 |
| 160 | " | 99 | 2.93 | .32 | 1.89 |
| Treatment LSD (.05) | | 7 | .15 | NS | NS |
| Mean values: | | | | | |
| $P_2O_5$ rate | 40 | 83 | 2.73 | .29 | 2.02 |
| | 80 | 87 | 2.82 | .29 | 2.07 |
| | 120 | 88 | 2.90 | .31 | 2.06 |
| | 160 | 91 | 2.84 | .31 | 1.97 |
| LSD (.05) | | 5 | .11 | NS | NS |
| $P_2O_5$ method | Broadcast | 82 | 2.80 | .30 | 2.09 |
| | Knifed | 92 | 2.85 | .30 | 1.97 |
| LSD (.05) | | 3 | NS | NS | NS |

## Effects of K Rates on Irrigated Corn Yields

This study was done in conjunction with the P study on irrigated corn just discussed.

Procedure: K rates used on this irrigated corn were 0, 50, 100, 150, 200, and 250 lbs $K_2O$/a. The site was fairly low (110 lbs K/A) in available K.

Results: 1980 yields were limited by extreme temperatures during pollination, however applied K significantly increased yields. (Table 23).

Conclusions: More work is needed before definite recommendations can be made concerning fertility rates for irrigated corn.

Table 23. Effects of K Rates on the Yields of Irrigated Corn, 1980

| Lbs/a | Parsons Field, Labette Co. | | | |
|---|---|---|---|---|
| | Grain yield | Tissue analysis | | |
| $K_2O$ | bu/a | %N | %P | %K |
| 0 | 104 | 2.91 | .33 | 1.58 |
| 50 | 114 | 2.94 | .31 | 1.68 |
| 100 | 119 | 2.83 | .30 | 1.79 |
| 150 | 121 | 2.86 | .31 | 1.91 |
| 200 | 120 | 3.05 | .32 | 1.89 |
| 250 | 120 | 2.96 | .30 | 1.90 |
| Treatment LSD (.05) | 12 | NS | NS | .21 |

## Effects of P Rates and Application Methods on Irrigated Soybean Yields

Purpose: The acreage of irrigated soybeans in southeast Kansas is increasing. Research is needed to determine fertility recommendations for irrigated soybeans.

Procedure: P rates of 40, 80, 120, and 160 lbs $P_2O_5$/a and broadcast and knifed methods of applying the P were evaluated. The site was low in available P. The beans were irrigated by sprinkler irrigation from a pit, but the shortage of water limited irrigation to about 2 inches in one application. Ammonium Polyphosphate (10-34-0), the P source, was applied preplant. The broadcast applications were incorporated, the knifed P was injected 8 inches deep on 15-inch centers.

Results: With just 2 inches of supplemental water and an extremely hot summer, the yields were respectable. Response to applied P was excellent and the knifed P gave 3 more bushels per acre than broadcast P (Table 24).

Conclusions: More work is needed before definite fertility recommendations can be made concerning fertility requirements for irrigated soybeans in southeast Kansas.

Table 24. Effects if P Rates and Application Methods on Yields of Irrigated Soybeans, 1980.

| Lbs/a $P_2O_5$ | Method of application | Parsons field Yield bu/a |
|---|---|---|
| 0 | - - - - | 17 |
| 40 | Broadcast | 20 |
| 80 | " | 22 |
| 120 | " | 23 |
| 160 | " | 22 |
| 40 | Knifed | 23 |
| 80 | " | 24 |
| 120 | " | 26 |
| 160 | " | 25 |
| Treatment LSD (.05) | | 7 |
| Means: | | |
| $P_2O_5$ rate | 40 | 22 |
| | 80 | 23 |
| | 120 | 25 |
| | 160 | 24 |
| LSD (.05) | | NS |
| $P_2O_5$ method | Broadcast | 22 |
| | Knifed | 25 |
| LSD (.05) | | 2 |

## Effects of K Rates on Irrigated Soybean Yields

This study was done in conjunction with the irrigated-soybean P study previously discussed.

Procedure: K rates of 0, 50, 100, 150, 200, and 250 lbs $K_2O$/a were incorporated before planting. The site was low in available K. Supplemental irrigation was limited to 1 inch for lack of irrigation water.

Results: Yields reflected the shortage of water, which probably limited yield response to K. No significant yield effects occurred.

Conclusions: More work is needed before definite fertility recommendations can be made concerning K fertilization of irrigated soybeans.

## Irrigation Scheduling for Soybeans

Purpose: Soybean irrigation in southeastern Kansas usually calls for less than 4 inches of applied water. Since producers have only limited water to put on, they need to know the best time to apply it.

Procedure: This study was established to find out the best time during the growth of the soybeans to schedule irrigation. The variety used was Essex. All treatments in 1980, except the control (not irrigated) received 3 inches of water before soybeans' reproductive growth stage.

Results: 1980 results show that soybean irrigation significantly increased yields with no significant difference between watering at bloom or at top pod fill. Watering at both times produced the highest yields (Table 25 ). This work will be continued.

Conclusions: To date, this research indicates soybeans respond well to supplemental irrigation at either first bloom or top pod fill growth stage.

Table 25. Irrigation Scheduling for Soybeans

| Irrigation, inches | Columbus field Yield, bu/a |
|---|---|
| No irrigation | 9.3 |
| 3* plus 1.5 at bloom (4.5" total) | 20.2 |
| 3 plus 1.5 at top pod fill (4.5" total) | 20.7 |
| 3 plus 1.5 at bloom plus 1.5" top pod fill (6.0" total) | 28.6 |
| LSD (.05) | 3.7 |

* The 3 inches were applied in 3 irrigations during the growing season before soybeans' reproductive stage.

## Evaluations of Varieties and Populations of Irrigated Corn

R. E. Lamond and K. W. Kelley

Purpose: Although we have considerable irrigated corn in southeastern Kansas, little information is available on variety performance. We need to know plant populations necessary to optimize irrigated corn production.

Procedure: This study evaluated twelve popular corn varieties grown in the area. Plant populations evaluated were 18,000, 22,000, and 26,000 plants per acre. Corn was seeded at 30,000 seeds per acre with final populations obtained by hand-thinning. The corn was irrigated from a large pond with a center-pivot system.

Results: Results are shown in Table 26 . Yield differences in varieties tested were small but two varieties produced significantly lower yields (LSD .10). The 26,000 population gave lower yields than either other population.

Conclusions: These data should be reviewed as inconclusive because hot, dry weather reduced yields and conclusions should be based on more than one year's data. The work will be continued.

Table 26. Evaluations of Varieties and Populations of Irrigated Corn, Vernon Eggbert farm, Crawford county, Kansas.

| Hybrid | | Yield, bu/a |
|---|---|---|
| DeKalb XL-63 | | 127 |
| Golden Harvest H-2500 | | 124 |
| DeKalb XL-72aa | | 123 |
| DeKalb XL-75 | | 122 |
| Prairie Valley 37S | | 120 |
| Hoegemeyer SG-2700 | | 119 |
| NC+ 59 | | 118 |
| Pioneer 3183 | | 118 |
| Bojac 56 RS | | 117 |
| Funks 4740 | | 116 |
| Pioneer 3184 | | 108 |
| NC+ 3990 | | 107 |
| | LSD (.05) | NS |
| | LSD (.10) | 10.2 |
| Populations | | |
| Plants/a | | |
| 18,000 | | 119 |
| 22,000 | | 122 |
| 26,000 | | 114 |
| | LSD (.05) | 6.1 |

## OTHER RESEARCH

Other research projects in soil and water management are either too preliminary or too inconclusive to justify reporting fully:

Residue Management Effects on Soil Chemical and Physical Properties. Burning, plowing under, physical by removing, or leaving wheat straw are being compared as residue management variables, to see if soil chemical and physical properties are affected by residue management.

Evaluation of the Nitrification Inhibitor, N-Serve. The nitrification inhibitor, N-Serve, is being evaluated in areas subject to denitrification.

Fertility Requirements of High-Yielding Wheat Varieties. Work is underway to see if wheat fertilizer recommendations need to be updated for the new high-yielding, semi-dwarf wheats.

Fertility Management for Irrigated Alfalfa. Work is underway to evaluate different fertility management factors for irrigated alfalfa.

Evaluation of a Till-plant System for Southeastern Kansas. Research has been started to evaluate the till-plant or "ridge-plant," reduced tillage system in this area.

Evaluation of Magnesium Suspensions on Tall Fescue. Work has started to see if directly applying magnesium suspensions to tall fescue increase Mg levels of fescue forage.

Evaluations of Methods for Establishing Double-crop Soybeans. Work is being conducted comparing different ways of establishing soybeans after wheat. Variables include plowing under wheat straw, burning, and a no-till method.

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