Inflation Fighters
Nebraska's Nutrition Aides
By Harriet Kohn

Omaha aide Lucille Eleby, right, teaches a homemaker to compare prices.

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It is true that the cost of food in the United States is reasonable compared to other countries. But “What’s for dinner?” is a hard question to answer for people of limited income. Even the old basic lower cost foods like beans, rice, noodles and flour have jumped in price.

The cost of living in 1974 rose an inflationary 12 percent. The average American family spent 19 percent of its income, after taxes, on food in late 1974. But many families with low incomes spent as much as 50 percent of it, after taxes, on food.

Nutrition aides are helping families who have a hard time getting by to make better choices of foods through education in food, nutrition and money management. The aides are part of the University of Nebraska’s Expanded Food and Nutrition Education Program. For short it is called the Expanded Nutrition Program (ENP). The ENP is part of the Cooperative Extension Service and operates through the County Extension Service in 22 counties. Families are called program families when they enroll in the program. The aide usually begins her work with the individual homemaker and family in their home. As soon as possible she encourages the homemaker to join a small learning group and helps the children get involved in 4-H club work and activities.

One aide relates this success story in working with a program homemaker:

“... My homemaker had three small children and knew little about food and nutrition. When she prepared a roast she gave the broth to the dog. The menus consisted of meat and boiled potatoes. “The homemaker and I developed a plan for her learning. The plan included sessions zeroing in on nutrition, use of vegetables and fruits in meals, shopping for food, menu planning, methods of food preparation and storage. “The homemaker now plans menus, budgets food money, raises a garden and cans food. She uses a variety of foods now and does much of her own baking. She keeps broth from meat and makes gravy. I feel this homemaker really changed her attitude toward food and has learned a lot about feeding her family nutritious meals.”

Nutrition aides teach food and nutrition to program family youngsters enrolled in 4-H activities. Volunteers help organize the activities. Aides feel they can often influence the nutrition of the family through the children.

When aides visit homemakers they take special note if the homemaker is using information given. One aide observed, “Mrs. S. had bought a turkey that was on sale and she fixed it in a variety of ways as we had suggested in our newsletter. I discussed the Chinese Liver and Onions recipe with her. We went on to talk about open dating and unit pricing of food. She said she would look for these next trip to the grocery.”

The aides find that vegetables and fruits are often low in the diets of their program families and so try to encourage their use.

Families who qualify for food stamps often benefit from the aide’s help. An aide recognized the great need one of her program families had for food stamps, but the homemaker refused to apply for them no matter how the aide tried to encourage her to do so. One day, the aide said, “When I was ready to leave I asked her again to think about buying food stamps. Could I help her fill out an application? She then told of her fear of making a mistake in the store and the embarrassment it would cause her. I promised to go with her to the store on her first trip buying with stamps and show her how to use them. She promised me she would apply for the food stamps. Next time I visited she had obtained food stamps and we made plans to go shopping for food.”

The aides work with small groups of homemakers. One aide mentioned, “We had a lesson on canning green beans last night. Each homemaker cleaned, cut and packed her own jar full. I always try to get in some nutrition relating to the food we’re preparing so

Harriet Kohl is Extension Specialist (Expanded Nutrition).
Inflation . . .

we talked about vitamin A.”

Families have a difficult time providing nourishing meals for their families for a number of reasons.

The cost of housing, utilities and other fixed expenses have risen at a higher rate than their incomes.

Money for food left after paying increased fixed household expenses is less than it used to be, yet the price of food is higher.

Many families on food stamps are buying only one half month’s supply of food stamps and trying to stretch them for the entire month.

Transportation difficulties prevent some from shopping at the cheapest market.

Children who are eligible for free or reduced school lunch and/or breakfast do not always participate.

Some of the inflation fighting tactics aides are suggesting to families follow. By the way, some of these tactics aides learned from the homemakers.

- Avoid waste in food through careful planning, buying, food preparation and storage.
- Don’t fall into the snack trap. Poorly chosen snacks like soft drinks and candy run up the food bill while running down your health.
- Plan meals after checking the food specials. Write out a shopping list. Compare prices per serving or unit when shopping.
- Buy only the perishable foods you can use while the food is in good condition.
- Prepare only the amount of food needed for the meal.
- Use edible parts of foods like the skin on vegetables and fruits.
- Don’t feed the drain with the vegetable cooking juices; put them in soups or mix with tomato juice to feed your family. Left over vegetables, bones, meat and gravy can be thrown into the soup pot, too.
- Put on your plate only the amount of food you need in order to avoid either waste or eating too much.
- Bake your own bread and rolls if possible. Add dry nonfat skim milk to boost the nutrition of the bread. Nonfat dry milk is good to drink when reconstituted.
- Store fresh, cooked, canned and frozen food carefully.
- Grow some of your own food and preserve it if possible.
- When food is short try not to eat it all today so some will be left for tomorrow.

In order to have enough money left for adequate food, aides suggest to homemakers that they also:

- Make a plan for spending their money.
- Use a checking account and mail to pay bills. It’s cheaper than bus or taxi.
- Pool the use of cars.
- Shut off rooms not being used to conserve fuel.
- Recycle materials rather than buy new ones when possible.
- Use covered washable storage containers instead of foil, waxed paper and plastic wrap.
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Another budget helper for families with limited incomes is an awareness of community services that are available to them. The families need to know about services such as low and reduced cost school lunches and the food stamp program. Often families need the help of the aide in applying and using these food programs and other services.

Aides have learned that program families may have many problems besides food and nutrition. The home economist who supervises the aide helps make referrals to agencies that can be of assistance. For example, when the father in a family lost his job the home economist and aide were instrumental in referring him to a job retraining program. As it turned out he did not complete the program, but his wife enrolled for job retraining, finished the course and got a job.

Nutrition aides themselves are women who live in neighborhoods where they work. Many have known hardships themselves. They are outgoing individuals who have the ability to relate to people and to see things through another person’s eyes.

The aide has 15 days initial training and about 8 hours a month continued training during her employment. The training sessions are coordinated by the ENI County or Area Extension Agent. About 60 part-time nutrition aids are employed in the Expanded Nutrition Program.


The Expanded Nutrition Program, which is financed primarily by Federal funds, started in Nebraska in 1969. Since then the aides have worked intensively with about 8,000 families with limited incomes and resources. Many more families have been reached through workshops and group meetings. Aides encourage program homemakers to continue to learn by participating in Extension and other community activities.
Alfalfa in Swine Finishing Diets

By Phil Grabouski and Murray Danielson

Optimum performance at minimum cost is what the pork producer must strive for. Increased feed costs have narrowed profit margins for livestock producers, and they are not necessarily using the same feed formulations at all times in their feeding programs. Producers could reduce feed costs by using alfalfa meal as a partial replacement for corn and also to replace part of the protein requirement usually provided by soybean meal.

For many years pork producers have been aware of the feeding value of alfalfa in the swine diet, whether in the form of pasture, dehydrated pellets or hay. Usually it was fed to gestating or lactating sows. Recently, diets which contained all alfalfa plus proper vitamins and minerals have been fed to gestating sows resulting in excellent reproductive performance. (See Fall 1974 Farm, Ranch and Home Quarterly). Since alfalfa hay is relatively high in fiber, it has not been generally used in concentrations greater than 2.5 percent of complete feed in growing and finishing diets.

Alfalfa hay of good quality will have a protein level of at least 15 percent on a dry matter basis, depending on many conditions which vary considerably during growth, harvesting, storage and processing prior to its addition to swine feeds. Alfalfa is rich in vitamin K and believed to contain unidentified growth factors.

Sixty-pound feeder pigs from the North Platte Station were fed sun-cured alfalfa meal in their diets until market weight. Diet formulations and chemical analyses appear in Table 1. Alfalfa meal was used as a replacement for yellow corn in a corn-soy diet at a level of 25 percent and also with additions of 0, 1.25, 2.50 and 3.75 percent lard.

The lard was incorporated into the diets containing 25 percent alfalfa to increase available energy in the diets. The available energy values of the high fiber diets 1, 2, 3 and 4 were similar to diet 5, the corn-soy positive control diet.

Alfalfa is readily available and usually priced reasonably in the central part of Nebraska. At the time this study was started animal fats were in surplus and reasonably priced. The pigs were fed a 16-percent protein diet for about 30 days followed with a 14-percent diet for the duration of the study or until they reached market weight.

Facilities for the pigs on each of these diets were comparable. Each pen of six pigs had like shelter, self-feeders and automatic waterers. The pigs were on feed from 76 to 90 days depending on when they attained a market weight of 220 pounds.

Table 2 shows the pigs’ performance. The replacement of corn with 25-percent alfalfa meal alone or with added lard reduced average daily gain of the pigs used in this study.

The pigs receiving diet 5, the 2.5-percent alfalfa meal corn-soy, had the highest daily gain of 1.99 pounds. Pigs fed diet 4 gained 1.86 pounds per day. The small difference suggests that this (Continued on next page)
higher level of lard may not have been as attractive to the pigs since the pigs on diet 3 gained 1.91 pounds per day. Pigs fed the 25-percent alfalfa meal and no lard diet gained 1.85 pounds per day—7.6 percent less than those on diet 5.

The pigs fed the 25-percent alfalfa diet required 3.85 pounds or 16 percent more feed per pound of gain than the pigs fed the corn-soy diet. Supplemental fat did not indicate a significant growth rate for pigs on the alfalfa meal diets and at the same time did not improve feed conversion.

**Daily Consumption**

The individual daily feed consumption ranged from 6.42 pounds for the corn-soy group to 7.11 pounds for pigs fed the 25-percent alfalfa diet. The feed consumption for pigs fed diets with added lard ranged from 6.86 pounds for the low fat diet to 7.06 for the pigs consuming the intermediate level of lard. The latter group had a more rapid daily gain and consumed the least feed per unit of gain. The high lard diet apparently approached the pigs’ energy requirements since the daily gains were not significantly different from those on the other lard added treatments, and the feed consumption per day was less per pig. Also, the high lard diet may not have been as palatable to the pigs consuming it, thus restricting their intake.

Early in the study, pigs on the corn-soy diet (5), consumed the greater quantity of feed per day. Apparently the high fiber content and/or some other factor present in alfalfa meal limited feed intake. As the pigs developed, the digestive systems of pigs fed alfalfa meal changed in some way, improving their ability to handle the high fiber diet.

This study suggests that the swine producer can effectively use alfalfa in the growing-finishing diet. The costs of gain will be reduced in periods of high protein and energy costs. However, the producer must weigh the effect of slow gain against low diet costs. The pigs must be maintained for an extra 5–10 days. The pork producer must determine if this system will be the most profitable for him. The addition of lard to the 25-percent alfalfa meal diets did not improve performance of pigs used in this study.

The results of this study would indicate that animals weighing more than 120 pounds utilize high alfalfa diets better than those below 120 pounds live weight, particularly if conditioned to consuming a high fiber diet.

Information obtained at slaughter indicates all carcasses were desirable from all treatments.

<table>
<thead>
<tr>
<th>Table 1. Percentage composition of diets.</th>
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<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td><strong>Ingredients</strong></td>
</tr>
<tr>
<td>Sun-cured alfalfa meal</td>
</tr>
<tr>
<td>Ground yellow corn</td>
</tr>
<tr>
<td>Soybean meal (44%)</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
</tr>
<tr>
<td>Calcium carbonate</td>
</tr>
<tr>
<td>Lard</td>
</tr>
<tr>
<td>Iodized salt</td>
</tr>
<tr>
<td>Trace minerals</td>
</tr>
<tr>
<td>Vitamin premix</td>
</tr>
<tr>
<td><strong>Chemical analysis</strong></td>
</tr>
<tr>
<td>Dry matter</td>
</tr>
<tr>
<td>Gross energy k cal/lb</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Ether extract</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Phosphorus</td>
</tr>
<tr>
<td>Ash</td>
</tr>
<tr>
<td>Crude fiber</td>
</tr>
<tr>
<td>Cell wall constituents</td>
</tr>
</tbody>
</table>

1 Supplied the following per kilogram of diet: Vitamin A, 3300 IU; Vitamin D3, 446 IU; Vitamin B12, 11 mg; riboflavin, 2.20 mg; niacin, 17.60 mg; calcium pantothenate, 6.68 mg; choline chloride, 2.20 mg.

<table>
<thead>
<tr>
<th>Table 2. Live animal measurements.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatments</strong></td>
</tr>
<tr>
<td>No. of pigs</td>
</tr>
<tr>
<td>Initial wt, lb</td>
</tr>
<tr>
<td>Final wt, lb</td>
</tr>
<tr>
<td>Avg. daily gain, lb</td>
</tr>
<tr>
<td>Feed/gain</td>
</tr>
</tbody>
</table>

1 Treatments were: (1) 25% alfalfa, 0% lard; (2) 25% alfalfa, 1% lard; (3) 25% alfalfa, 2.5% lard; (4) 25% alfalfa, 3.75% lard; (5) 2.5% alfalfa, 0% lard. ∗Significantly different at the .05 level. ∗∗Significantly different at the .01 level.
How To Determine Profitable PROTEIN LEVELS FOR SWINE

by Larry L. Bitney and Bobby D. Moser

Maintaining a profit margin with pigs has been complicated in the past 2 years by widely varying prices for grain and protein supplement.

The price of soybean meal topped $400 per ton in the spring of 1973 while the local price of corn was below $1.50 per bushel. Many pork producers wondered whether they could increase their profits by lowering the level of protein supplement fed even though their pigs might not do as well.

In the fall of 1974, soybean meal was slightly less than $200 per ton while corn was $3.50 a bushel. Producers then needed to know if they could make more efficient use of high priced grain by increasing protein supplements above traditionally recommended levels.

Recommended levels of protein in swine diets traditionally have been based on optimum performance—gain and feed conversion. Now, however, cost-conscious pork producers are keeping an eye on the relationship between grain and protein supplement prices as they formulate swine rations.

While pig performance is still important, many producers want to know which are the most economical protein levels to feed when grain and protein supplement prices fluctuate.

To answer that question, we compared gain and feed conversions for pigs of different weights fed different protein levels. The results of more than 20 experiments were reviewed to determine the expected performance with different levels of protein. Weighted averages of the performance of pigs on various protein levels are reported in Table 1.

**Economic Analysis**

A break-even analysis was applied to the data in Table 1 to determine the effect which corn and soybean meal prices have on the selection of protein levels in swine growing-finishing rations. The three weight groupings used are those shown in Table 1: 40-100 pounds, 100-170 pounds, and 170-250 pounds. This in no way suggests that producers should feed hogs to 250 pounds, but reflects the weight ranges for which data were available.

The results of the analysis are shown in Figure 1 (next page), with one chart for each weight group. The solid lines in each chart represent a series of break-even points, or divisions, between suggested protein levels. The spaces between the lines represent areas in which a given protein level is suggested.

The suggested protein levels shown on the charts represent those levels which produce the lowest cost of gain. Rations which resulted in slower gains were charged penalties for the added labor, utilities, buildings, and equipment costs which would be incurred if they were fed.

To use the charts, look at an example from the 170-250 pound weight range. First, let's consider the price relationship which existed for several years prior to the recent price fluctuations—$1.00/bu. corn and $100/ton soybean meal. We locate the $1.00/bu. corn price on the vertical axis of the chart, and the $100/ton soybean meal price on the horizontal axis. When we draw dotted lines to the right and upward from these points, the lines meet at point “a” in the “12-percent area” of the chart. Thus, with this price relationship, a 12-percent ration should be most profitable for pigs at this weight.

Now let's look at the prices which existed in the spring of 1973—$1.50 corn and $400/ton soybean meal. Using these prices, we arrive at point “b,” which is in the “10-

**Table 1.** Average daily gain and feed per pound of gain as affected by weight of pigs and protein level of ration.¹

<table>
<thead>
<tr>
<th>Weight range, pound</th>
<th>Protein level, %</th>
<th>Avg. daily gain, pound</th>
<th>Feed/gain, pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-100</td>
<td>12</td>
<td>1.27</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>1.38</td>
<td>2.58</td>
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<tr>
<td></td>
<td>16</td>
<td>1.46</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>1.51</td>
<td>2.53</td>
</tr>
<tr>
<td>100-170</td>
<td>10</td>
<td>1.26</td>
<td>5.08</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>1.65</td>
<td>3.56</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>1.70</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1.73</td>
<td>3.39</td>
</tr>
<tr>
<td>170-250</td>
<td>10</td>
<td>1.71</td>
<td>4.37</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>1.80</td>
<td>3.92</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>1.76</td>
<td>3.80</td>
</tr>
</tbody>
</table>

¹Table values are weighted averages from applicable studies.

(Continued on next page)
Economic Rations . . .

percent area" of the chart. This tells us that the producers which lowered the protein levels slightly in their swine diets during that period were doing the right thing.

Using fall, 1974 prices—$3.50/bu. corn and $200/ton soybean meal, we arrive at point "c," which is on the borderline between the "12-percent area" and the "14-percent area" of the chart. This tells us that our profits will be equal with either protein level. You may want to consider one of the following alternatives in such a "borderline" situation.

1. Consider feeding the higher protein ration (14 percent in the example) while the pigs are in the lower part of the weight range, and start feeding the lower protein ration when they reach the upper part of the weight range.

2. Consider feeding a ration with a protein level which is in between the two. In this example, a 13-percent ration would be appropriate for areas near "boundary line" between 12-percent and 14-percent rations.

3. If you will not have a new batch of pigs waiting for the facility, and if you have extra time to care for the pigs, you might choose the lower protein ration if you are close to a "borderline."

The following points should be considered when reading and using the charts in Figure 1:

These charts are intended as a guide for use in selecting protein levels. Variation in type of hogs, environment, management, protein sources, etc., will affect individual decisions.

How Long?
Pigs which are fed a lower protein ration will generally take longer to reach market weight, but the added time may not be great. Based on the data in Table 1, pigs which are fed rations of 14 percent from 40-100 pounds, 12 percent from 100-170 pounds, and 10 percent from 170-250 pounds will take about seven days longer to go from 40-250 pounds than pigs which are fed rations of 18, 16 and 14 percent in each of the weight ranges.

The time required to reach market weight becomes a more important consideration when: (a) the hog market is trending upward or downward, (b) rigid production schedules must be met, (c) rapid turnover is desired, or (d) producer wants to maximize weight gains per facility unit.

The different protein levels shown may result in minor differences in carcass quality. It is doubtful if this would significantly affect the price a producer receives for his hogs.

The charts in Figure 1 reflect added carrying costs of slower gaining hogs resulting from lower protein rations. Producers with loose production schedules and who have the extra time required can justify a slightly lower protein level than those shown in Figure 1.

The charts in Figure 1 are based on rations which use soybean meal as the only protein supplement. More expensive protein sources would result in lower suggested protein levels than shown in Figure 1. The opposite is true for lower cost protein supplements.

Effective of Market Price

Does the market hog price affect the protein level which should be fed? It does only if the protein level affects the number of hogs marketed per year, or the weight at which they are marketed. The effects of an uptrending or downtrending market have already been mentioned.

If a producer has enough slack in his production system to hold hogs up to a week longer than normal, he could adjust protein levels within the relevant ranges of Figure 1 and still market the same number and weight of hogs as he normally would. The analysis in Figure 1 is aimed at a producer in this situation. Thus, market hog price is not considered as a factor in the analysis.

Fig. 1 Suggested protein levels for swine growing-finishing rations based on corn and soybean meal prices.
Morrill County farmers get a MILLION POUNDS OF EDUCATION

Morrill County Agent Densel O’Dea, left, and farmer Walter Franklin examine a newly planted field for planting depth and fertilizer replacement.

By Densel W. O’Dea and Louis A. Daigger

“I’d rather see a lesson than hear one any day.”

Farmers sharing this often heard opinion about education programs have been given opportunities to see lessons in fertilizer use in Morrill County since 1960. Over a million pounds of fertilizer—536 tons—have been used so far in demonstration lessons.

The Morrill County Extension Service’s main objective is to show fertilizer response on individual farms to indicate the fertilizer’s worth to the farmer cooperator and to his neighbors. Even though the type of demonstration has been changed through the years, the objective is the same—to upgrade fertilizer know-how of the community.

Involvement of the Tennessee Valley Authority (TVA) has been vital to the program’s success from the beginning. And Morrill County is the only Nebraska county with which TVA currently cooperates in this unique way. Fertilizer materials have been shipped by TVA to local fertilizer distributors. Farmers participating in the demonstration programs are sold fertilizer at a slightly lower cost to help defray extra expense involved in allowing the work to be done on their farms. The farmer cooperator also agrees to keep de-

(Continued on next page)

Densel W. O’Dea is Extension Agent Chairman, Morrill County; and Louis Daigger is District Extension Specialist (Soils) at Panhandle Station.
Million Pounds . . .

tailed records and leave unfer-tilized areas in his fields to show fertilizer responses.

County Extension personnel have been responsible for determining the kinds and amounts of fertilizer to use through soil tests and have ordered and distributed the TVA materials. The County Extension Board selects cooperators. The first participants were those who had adequate machinery to carry out the program and would influence other farmers in adopting beneficial practices on their farms.

The first program, from 1960 to 1965, was the unit test demonstration. Some 470 tons of fertilizer were applied to the corn, wheat, alfalfa, sugarbeets and sub-irrigated meadows of five farmers.

Fertilizer recommendations were made by the county Extension agent from soil tests. Sugarbeet yields were increased 6 to 8 tons per acre; corn from 20 to 25 bushels per acre. Winter wheat yields increased by 4 bushels per acre and protein increased 1.5 percent.

Meadow Yield

The most outstanding yield increase was on subirrigated meadows. The first year, after applying 60 pounds phosphate per acre, yields were increased from 1,600 pounds hay per acre to 4,500 pounds. The increase was largely due to activation of dormant alike clover, which cows then picked out to eat during winter feeding. Results encouraged many ranchers in western Nebraska to fertilize sub-irrigated meadows.

An important achievement of the program was the introduction of new fertilizer materials. TVA test materials made in pilot plants were available for small result demonstration plots and shipped with the other materials. One of these was ammonium polyphosphate now widely used in the area. Special blends of zinc also were tested and results reviewed by TVA personnel to determine if the product should be manufactured for the retail trade.

There were "spin-offs" from the program. Observations by farmers and Extension and TVA personnel raised questions that prompted research on specific problems. These problems involved not only fertilizer use but irrigation needs, need for improved cultural methods and improved farm machinery.

Farm visits by Extension and TVA personnel during the first 5 years of the program established a close personal relationship between the county Extension agent and the cooperators. Many problems not associated with fertilizer use were discussed and assistance given. Weed control in all crops, specific soil problems, harvesting methods, assistance in farm record keeping, use of tensiometers to determine if irrigation practices could be improved are only a few of the aids given for a more efficient farming operation.

The demonstrations that began with larger, established farmers as cooperators showed that there was a need to aid small operators with a total management program, not just help in fertilizer use. Fertilizer was the key to establishing a program where all phases of farm management and production could be viewed.

Donald Siffring, county Extension Agent Chairman of Morrill County, made the first step in establishing such a program in 1970. He established a committee composed of area Extension specialists, local businessmen, TVA representatives, government personnel and farmers of the area. This committee assisted in selecting the cooperators and served as an advisory board. The Extension specialists were to be involved in the actual program operation.

Siffring felt that a close relationship between the cooperator and Extension agent was necessary and that specialists should be available for on-the-farm visits. Specialists could often be more frank with the cooperator than the agent.

Siffring worked up a step-by-step management program for top production of six main crops in the Nebraska Panhandle. The program was outlined in a leaflet form and given to the cooperators. Specialist could do to improve his farm operation. Specialists were then called in to assist when needed.

Success Stories

One example which shows how the new program worked involved a young farmer who didn't have up-to-date corn planting equipment. He felt he could not afford a new planter and decided to have a neighbor with modern machinery custom plant the corn. The use of fertilizer and good cultural management doubled his corn yields the first year.

Another farmer was encouraged to have his sugarbeets planted by the grower service of the Great Western Sugar Company. After his first year growing sugarbeets he was ready to invest in a planter and plant his own beets.

The greatest measurable progress with the county's soil fertility program has been with the several smaller farmers using Extension personnel for a total farm management program. Three of the cooperators have indicated that they have finally earned enough to pay income tax for the first time.

Their farms have improved buildings, a new home, more attractive farmstead and upgraded sanitation facilities. These cooperators are showing improved skills in analyzing problems and making decisions toward their solution. They say they want to continue in the program—an indication that it is working.

Not all the progress has been in the newest phase of the program, however. Fertilizer use has changed resulting in more efficient use and increased yields.

Tests with pilot plant materials did much to encourage the use of new materials. This alone has added much to the area's economy. The education gained from lessons farmers could see has resulted in a stronger, more profitable agriculture in Morrill County.
Is Car Exhaust Poisoning Our Corn?

By Lowell Satterlee, N. Y. Zachariah and R. M. Hill

Lead pollutants from automobile exhaust are recognized as hazards to the air breathed by humans and animals. But they also are a threat to plant life, particularly that grown along well traveled highways.

Investigations into lead pollution on corn in Nebraska have shown considerable amounts of lead on plants and in soil near highways, but not on parts of the plant consumed by humans.

This research supports studies in the Los Angeles area where much higher lead levels were found in soil in 1967 than in samples collected between 1919 and 1933. Lead levels in the top inch of soil were much higher than those found at depths of 18 inches.

Lead on Corn

The purpose of the Nebraska research was to study the levels of lead on the leaves and ears of corn and surrounding soil at varying distances from selected Nebraska highways.

The corn studied was planted in May 1972 and samples collected the following October from fields along Interstate 80 near Lincoln where traffic volume was about 15,000 vehicles per day.

Samples of soil, leaves and ears were taken at three sites within each field: along the highway (exterior), in the middle of the field, (middle) and back of the field farthest removed from the highway (interior). Samples also were collected from fields adjacent to roads where the volume of traffic was of medium intensity, approximately 400 to 500 vehicles per day. A control sample was collected from fields along a county road where traffic was fewer than 250 vehicles per day.

Significant quantities of lead were present in the surface layer of soil in those areas where traffic volume was moderate to heavy (Table 1). Very small amounts were detectable in the soils where the number of passing vehicles numbered fewer than 250 per day. Those fields near the heavily traveled I-80 showed a marked decrease in surface soil lead as the distance from the highway increased.

The corn leaf samples showed a distribution pattern very similar to the soil samples. Those plants closest to moderate or highly traveled roadways contained the greatest concentration of lead in the leaves, while those further removed from the highway contained much less lead. Those plants grown in fields where adjacent traffic levels were low occasionally exhibited trace amounts of lead in their leaves, but in most cases no lead could be detected by the method used.

In the case of the dried, ground corn kernels, only two samples contained detectable quantities of lead and these were just above the minimum level of detection.

The lead that is contained in exhaust from automobiles built prior to 1975 and gasoline burning trucks is emitted in particulate form which settles upon the fields adjacent to the highway. The lead adheres strongly to the surface of the leaves and soil. Since it is insoluble in water, it is not leached into soil readily nor is it washed from the leaves.

The corn itself is protected from the particulate lead settling on the field by the husk which is stripped away at harvest and discarded. These protective factors such as the insolubility of lead and the presence of the husk make lead contamination of the kernel, from automobile and truck exhaust, of only minor concern.

This is also true in the case of any crop where the edible portion is protected by an outer covering which is removed during processing. What might be a real problem may arise when the husks and leaves are eaten after harvest by farm animals. Only when these crops are used as forage or consumed in their entirety by humans or animals could the lead on the surface of the leaves and husk be of any consequence.

Control Measures

In the United States, chemical catalysts have been successfully used to purify gases and vapors in various manufacturing processes. The removal of potential air pollutants from automobile exhaust via the use of catalytic devices has been difficult. Deactivation of exhaust catalysts by lead and high temperature has brought about the use of nonleaded gas in all 1975 cars.

The use of nonleaded gas will begin to lower particulate lead emission, but it will be many years before all automobiles use unleaded gas. □

Table 1. Lead concentrations in corn leaf, kernel and surrounding surface soil

<table>
<thead>
<tr>
<th>Traffic Intensity</th>
<th>Location within the field</th>
<th>Soil (Micrograms lead per 5 grams dry material)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Leaf</td>
</tr>
<tr>
<td>High (12,000-15,000</td>
<td>Exterior</td>
<td>4.26</td>
</tr>
<tr>
<td>vehicles/day)</td>
<td>Middle</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td>1.96</td>
</tr>
<tr>
<td>Moderate (400-500</td>
<td>Exterior</td>
<td>0.70</td>
</tr>
<tr>
<td>vehicles/day)</td>
<td>Middle</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td>0.75</td>
</tr>
<tr>
<td>Low (250)</td>
<td>Exterior</td>
<td>0.10</td>
</tr>
<tr>
<td>Vehilces/day)</td>
<td>Middle</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1 All values reported are means obtained from 5 fields (high intensity), 3 fields (moderate intensity) and 4 fields (low intensity).
2 Not Detectable. Less than 0.01 micrograms per 5 gram sample.
Nebraska's Range and Pasture Resources

by James T. Nichols and L. J. Perry, Jr.

Rangeland is truly one of Nebraska's most important natural resources, not only because of its sheer magnitude, but also because it is a vital forage component supporting the beef cattle industry. Nebraska has about 24 million acres of rangeland and 1.5 million acres of improved pasture (Table...
1). Together these grazing resources make up 52 percent of Nebraska’s land area.

Recent advances in grain prices have encouraged producers to put more of Nebraska’s acres in cultivated crops. Rangeland, however, will likely remain as grassland in the foreseeable future. Topographic, soil, and climatic factors place severe restrictions on its use as cultivated land. One notable exception is the development of sprinkler irrigation on selected sites which are suitable for crop, hay, and irrigated pasture production. These developments can complement rangeland for a better balanced total forage program, but range is not likely to be replaced as the principle forage resource in most of Nebraska’s ranching areas.

**Concern to Producers**

The level of present rangeland productivity as well as its potential should be of real concern to livestock producers. Range and pasture plants must be kept vigorous and healthy for efficient, sustained livestock production. If using less grain and more forage becomes a more widely accepted practice to grow and finish beef cattle, then range and pasture will assume an even more important role in the future. Also, efficient range and pasture production is of economic importance for Nebraska to remain competitive with cattle producing areas receiving higher rainfall, which can readily produce large quantities of forage for increased beef cattle numbers.

Productivity of Nebraska’s rangeland has not kept pace with mechanically harvested forage crops, grain crops, and other agricultural products. Doubled and tripled yields for many crops have become common during the last 30 years because of advanced knowledge and technology. In contrast, range productivity over the Great Plains as a whole has declined since the 1800’s when domestic livestock numbers reached full range utilization. Nebraska’s Sandhills are an exception overall, but even here some areas show evidence of depletion and reduced production.

Much of Nebraska’s rangeland is overgrazed and hardly resembles the vegetation which once

*(Continued on next page)*

Below, irrigated pasture can increase the total productivity of a Sandhills ranch unit by serving as a complementary forage crop.
Range and Pasture...

dominated it. For example, some vegetation has shifted from mid and tall grasses to less productive short grass species. Other areas support mostly unpalatable, weedy plants in place of grasses. These rangelands definitely offer a potential for greater productivity, and in many cases need a drastic program of range improvement.

What's Needed?

In 1969 the Soil Conservation Service completed a detailed inventory of conservation needs which indicated that much of Nebraska's rangeland could benefit from range improvement practices (Table 2). This report suggested that approximately 62 percent of Nebraska's rangeland, or over 14 million acres, needed some type of range improvement, from more conservative grazing to complete reestablishment. These are lands that do not have a desirable plant cover, thus production is less than optimum. An increase of 25 percent in forage production on these acres would be equivalent to adding 3.5 million acres of range for livestock production. A 25-percent increase is conservative for some areas. Forage production of those sites where reseeding is warranted could increase production many times over.

Perhaps the most significant aspects of this potential increase in range production are improved stability of beef cattle production and increased grazing capacity. The consequences of unstable range were felt in 1974 when rangeland already in poor condition deteriorated earlier and more severely under drought stress than rangeland in good condition. Stockmen had to move cattle off the poor range and find other grazing land. Stable, productive rangeland also is beneficial to most aspects of resource conservation and wildlife habitat.

It is possible that some years from now research and improved technology could increase forage production beyond that currently possible with proper management of native vegetation. However, in the immediate future most of Nebraska's rangeland will be managed as native vegetation, applying ecological principles to grassland management. Maintaining range in good condition is important for sustaining high production. Manipulation of livestock grazing is the primary factor determining improvement or deterioration of range condition.

What About Pasture?

Nebraska has about 1.5 million acres which have been seeded to cool-season grasses (Table 1). These improved pastures make up only a small acreage compared to rangeland, but are a very important forage resource in many areas. This kind of pasture is best adapted to fertile soils and higher rainfall, thus is most common in crop production areas and eastern counties of the state. However, some selected sites and soils within range areas have been successfully seeded.

Improved pastures require intensive management practices such as fertilization, use of improved grass varieties, intensive grazing management, and periodic renovation. As a consequence, greater forage production is expected from these pastures than from native rangeland within a given geographic region. Improved pastures can supply specific forage needs during critical periods of the year when the proper grasses are chosen.

Irrigated pastures have become an important part of the forage program in Nebraska. A recent survey indicated there are approximately 150,000 acres of irrigated pastures in Nebraska, most of which are being used in conjunction with rangeland. Some areas of what was once rangeland are now being irrigated, resulting in an increased carrying capacity of approximately 20 times that of dryland range. Automated sprinkler irrigation can be used on sites not previously considered irrigable.

Table 1. Major land uses in Nebraska.

<table>
<thead>
<tr>
<th>Land use category</th>
<th>1,000 Acres</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangeland (native grasses)</td>
<td>23,884</td>
<td>49</td>
</tr>
<tr>
<td>Cropland (irrigated and non-irrigated)</td>
<td>20,014</td>
<td>41</td>
</tr>
<tr>
<td>Improved pasture</td>
<td>1,439</td>
<td>3</td>
</tr>
<tr>
<td>Forest and woodland</td>
<td>976</td>
<td>2</td>
</tr>
<tr>
<td>Other uses</td>
<td>2,687</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>24,020</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Range and pasture improvements as suggested by Nebraska Conservation Needs Inventory.

<table>
<thead>
<tr>
<th>Suggested range improvement</th>
<th>1,000 Acres</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Protection from overgrazing (plant composition adequate, but overgrazed)</td>
<td>7,909</td>
<td>33</td>
</tr>
<tr>
<td>2. Improvement of plant composition (plant composition not adequate)</td>
<td>5,465</td>
<td>23</td>
</tr>
<tr>
<td>3. Brush control (undesirable woody plants need control)</td>
<td>365</td>
<td>2</td>
</tr>
<tr>
<td>4. Reestablishment of vegetation (desired vegetation is not present)</td>
<td>966</td>
<td>4</td>
</tr>
<tr>
<td>5. Treatment not needed</td>
<td>8,940</td>
<td>37</td>
</tr>
<tr>
<td>6. Treatment not feasible</td>
<td>239</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>23,884</td>
<td></td>
</tr>
</tbody>
</table>
Mothers and Teens Set

CLOTHING GOALS

Because clothing is an indicator of an individual's values and economic situation, low-income persons sometimes lose self-esteem when their limited buying power prevents them from achieving their clothing goals.

To find out what these goals are, a recent study in Lancaster County examined five considerations of clothing buyers and how mothers and teenagers from low-income families ranked them in importance. The mother and oldest teenager in 11 AFDC (Aid to Families with Dependent Children) families were asked to project the use of additional money in their clothing budget. They were asked, "If you had $10.00 additional to spend on your clothing, how would you rate the following in order of importance: top brands, better store service, more garments, garments like other were wearing, and better quality?" The rating scale was 1 to 5 with 1 the highest.

The findings indicate a significant difference in two of the considerations. Top brands were more important to the mother than to the teenager. Garments like others were wearing were more important to the teenager than to the mother (Table 1). This finding agrees with other research studies that peer group approval is important to adolescents.

The mothers and teenagers agreed that the most important consideration was quality. Nine mothers and six teenagers rated quality as number one and no mother or teenager rated quality as least important.

---by AUDREY NEWTON, Chairman
Department of Textiles, Clothing and Design

Table 1. Rankings of considerations for projected clothing funds by mothers (M) and teenagers (T). Numbers indicate number of responses.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better store service</td>
<td>M0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>T0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Top brands</td>
<td>M0</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>More garments</td>
<td>M2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Like others</td>
<td>M0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Better quality</td>
<td>M9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>T6</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

because of uneven topography and sandy soils.

Improved and stabilized production permits expansion under ranching situations which would not be possible without irrigation. There now are alternatives and possibilities for changing production and management practices to achieve a balanced forage and livestock program. Until recently, this has been very difficult in many ranching areas because of restrictive environments.

Annual crops used for grazing include sudan grass and the small grains: wheat, rye, oats, and barley. Although these pastures are not a primary forage source, they may meet a need during critical periods of shortages of other forage resources. Sudan grass provides excellent summer pasture when cool-season grasses are least productive. Annual small grain crops can fill a forage need during fall and early spring when warm-season grasses are least productive. Little information is available on acreage or use of annual pastures. The potential is primarily in areas of cultivated land and where livestock production is secondary to grain crops.

Nebraska has a tremendous range and pasture resource, and improvement practices offer numerous opportunities for increased forage production. In addition, a program using rangeland along with improved pasture, irrigated pasture and other forages where feasible, can provide better balanced forage programs and added total productivity.

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15
Programs for intensive rehabilitation of mentally and physically ill veterans are offered by Veterans Administration hospitals. In many of these VA hospitals, horticulture therapy is included because it brings significant improvement in the patients involved. Horticultural activities develop a sense of accomplishment through acquiring new knowledge and skill, bringing relaxation and enjoyment, exercising the body through physical work, occupying time otherwise spent in idleness, and reducing isolation by providing group activities.

The VA-UNL Partnership

In the past, horticultural activities for patients at the Lincoln Veterans Administration Hospital were carried out in cooperation with community volunteers. Patient interest and participation was limited, however, and it was not possible to develop a consistent, well organized, on-going program.

Chief of Psychology J. F. Merker suggested that the Department of Horticulture of the Institute of Agriculture and Natural Resources at UN-L be consulted and invited to evaluate the situation at the hospital.

Negotiations for developing the program with the University's Department of Horticulture were started in April, 1973. The Department provided a minimum of two students majoring in horticulture as well as professional consultation to advise and assist the students in their work in the hospital. The students were employed directly by the hospital on a part-time basis and their work was coordinated and supervised by the Chief of the Psychology Service.

This initial program established horticulture therapy on a solid foundation at the hospital. It stimulated high interest and participation on the part of patients and helped beautify the hospital grounds.

In view of this success, an agreement covering the period from July 1, 1974, through June 30, 1975, was drawn up between the Department of Horticulture and Lincoln Veterans Hospital. The hospital provided the financing needed by the Department for developing a continuing and expanding horticulture therapy program for patients and for consulting regarding the beautification of the hospital grounds.

Success of the program depends greatly on the quality of students selected. Preference is given to horticulture majors of good standing who are at least sophomores or graduate students. Ability to communicate and work cooperatively with others, psychological and social perceptiveness, maturity in thought and bearing, and innovativeness and versatility are some of the personal attributes sought.

Scope of Activities

Patient involvement is the key to measuring the success of the horticulture activities carried out. The task of scheduling a variety of year-round activities was possible because of the availability of a greenhouse and grounds at the hospital. Following are the objectives of the program and responsibilities of the students and consultants for its implementation:

- Developing and implementing a year-round program involving foliage plants, vegetables, and flowering plants in the greenhouse and hospital grounds.
- Designing, preparing, planting, and maintaining a summer vegetable garden.

The University and The Veterans Administration: Partners in Horticulture Therapy

S. S. Salac, J. F. Merker, R. E. Neild and J. O. Young

S. S. Salac is Assistant Professor, Ornamental Horticulture; R. E. Neild is Associate Professor and J. O. Young is Professor of Horticulture; and J. F. Merker is Chief, Psychology Service, Lincoln Veterans Administration Hospital.
- Designing hospital grounds beautification projects involving flowers, shrubs and trees.
- Recommending to Engineering Service appropriate methods of greenhouse maintenance and the care of hospital grounds.

Specifically, students in the project's first year lectured and demonstrated terrarium culture, plant propagation, pruning and grooming of plants, flower arranging, and the establishment and maintenance of flower, desert, rock and vegetable gardens. They showed patients how to force flowering bulbs, prepare and sterilize soil mixes and other plant growing media, pot and repot plants, how to recognize and control diseases and pests, how to use fertilizers, and other techniques.

Students contacted and met patients on the wards to stimulate their interest and inform them about the project. The students also attended hospital staff meetings to offer feedback on patient activities in horticulture.

They worked with patients on various greenhouse and outdoor gardening and beautification projects and helped the patients to take pride in their accomplishments and contributions to the improved appearance of their hospital.

**Program Appraisal**

The horticulture therapy program has contributed significantly to the mission of the hospital in rehabilitating mental, alcoholic, and physically handicapped patients. Involvement with horticultural activities through the assistance of well trained and perceptive horticulture students benefited the patients physically and psychologically.

For example, one of the horticulture students observed, “I could see many patients open up and talk more. On their first visit, they may not have said much or shown much interest, but they would come back and ask for a plant or make a terrarium or volunteer to help. The green atmosphere really seemed to relax them.”

**Students Gain**

The students, likewise, gained much needed field experience in the practice of horticulture therapy. Invariably, the students developed greater poise and confidence in working with people.

Excellent progress has been made in the overall management (Continued on next page)
Therapy...

and development of the hospital greenhouse. It underwent extensive repair, plants are given regular and proper care, and all activities performed are well organized.

Landscaping with shrubs and trees and establishment of flower beds and a vegetable garden have greatly enhanced the hospital environment. Interior beautification of the hospital through the use of plants propagated and grown in the greenhouse is also one of the added benefits derived from the program.

Patients are allowed to take the plants they grew when they leave the hospital. This provides continuity of their activity and bridges the gap from hospital to home and community life. Some of them also become good amateur home horticulturists as a result of the experience gained in the program.

Above, hospital staff members enjoy the "greening" of wards and rooms. Below, patients and students work together in the hospital flower garden.
Weather uncertainties will again plague dry bean producers this year as they get ready to plant the 1975 crop. Planting too early could endanger seedlings to late spring freezes and low soil moisture. Planting a little later could expose plants to high temperatures during blossoming and pod set. Late planting risks hail damage and early fall freezes.

No good means yet exist for forecasting weather from one growing season to the next. But analysis of long-term weather records can help determine expected changes during a growing season.

The expected weather hazards for different plantings simulated every 5 days between May 1 and June 30 are shown in Table 1. These data permit different planting times to be compared on the basis of the kind of growing conditions to be expected.

June 1 to June 15 is the most favorable time for bean planting to minimize weather risk. These dates were chosen after reviewing average temperatures, numbers of days between planting and emergence, precipitation, spring and fall freeze probabilities, high temperature frequency, and numbers of hailstorms for different planting dates.

**Days To Emerge**

The number of days it takes plants to emerge decreases rapidly from May through June as temperatures get warmer. A May 1 planting would require 23 days to emerge, compared to 9 days for a planting the last of June.

The chances of a late spring freeze after emergence decreases from 19 percent for the May 1 planting date to less than 1 percent by the end of the month. There is a 3 percent chance that a June 5 planting may be frosted in the fall before the crop is mature. This fall freeze risk increases with delayed planting and is 68 percent by the last of June.

Studies also have examined average precipitation per day for the period from planting to emergence. No planting date is particularly favored from the standpoint of rainfall. For most planting dates, canal irrigation water usually is not available until after the germination period is past.

**Trade Hazard**

Sometimes producers will trade protection from one hazard for dangers of another. Hail damage could be avoided by planting early in May, but this would subject the seed to adverse germination temperatures. Late June plantings, although more favorable for germination, are subject to greater fall freeze risk.

High temperatures during blossoming can be dangerous to dry bean plants. The chance of 2 or more days per week reaching 94° or higher during the critical blossoming period increases from 16 percent for early May plantings and ranges between 45 and 48 percent for plantings between May 21 and June 15, after which it declines.

While June 1-15 is the least hazardous planting period, special effort should be made to assure that these plantings are adequately irrigated prior to blossoming. This critical time coincides with a period when high temperatures are common, and irrigation serves to moderate adverse effects on the plant.

---

**Dry Bean Planting, Weather Or Not**

by Ralph Neild and Don Wilhite

Table 1. Expected weather hazards for different field bean planting dates.

<table>
<thead>
<tr>
<th>Planting date</th>
<th>Average temperature of planting to emergence (°F)</th>
<th>Number of days planting to emergence</th>
<th>Daily average precipitation (inches)</th>
<th>Probabilities (%) of 2 or more days per week above 94° during blossoming</th>
<th>Average number of hailstorms between blossoming and maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1</td>
<td>55.3</td>
<td>23</td>
<td>.093</td>
<td>19   16 0.93 1.61</td>
<td>19.3 16 0.93 1.61</td>
</tr>
<tr>
<td>6</td>
<td>56.6</td>
<td>20</td>
<td>.097</td>
<td>15   25 1.05 1.52</td>
<td>10.5 25 1.05 1.52</td>
</tr>
<tr>
<td>11</td>
<td>58.0</td>
<td>18</td>
<td>.105</td>
<td>10   32 1.15 1.44</td>
<td>6.1 38 1.21 1.37</td>
</tr>
<tr>
<td>16</td>
<td>59.4</td>
<td>16</td>
<td>.106</td>
<td>6    38 1.21 1.37</td>
<td>3.3 38 1.21 1.37</td>
</tr>
<tr>
<td>21</td>
<td>61.0</td>
<td>15</td>
<td>.107</td>
<td>2.5  42 1.25 1.31</td>
<td>2.5 42 1.25 1.31</td>
</tr>
<tr>
<td>26</td>
<td>62.3</td>
<td>13</td>
<td>.106</td>
<td>2     45 1.25 1.33</td>
<td>2  45 1.25 1.35</td>
</tr>
<tr>
<td>31</td>
<td>63.9</td>
<td>13</td>
<td>.093</td>
<td>0.9   46 1.17 1.19</td>
<td>0.9 46 1.17 1.19</td>
</tr>
<tr>
<td>June 5</td>
<td>65.3</td>
<td>12</td>
<td>.096</td>
<td>3     47 1.14 1.13</td>
<td>3  47 1.14 1.13</td>
</tr>
<tr>
<td>10</td>
<td>66.5</td>
<td>11</td>
<td>.096</td>
<td>7     48 1.15 1.07</td>
<td>7  48 1.15 1.07</td>
</tr>
<tr>
<td>15</td>
<td>67.9</td>
<td>11</td>
<td>.093</td>
<td>15    46 1.02 0.92</td>
<td>15  46 1.02 0.92</td>
</tr>
<tr>
<td>20</td>
<td>68.9</td>
<td>10</td>
<td>.089</td>
<td>29    42 1.00 0.83</td>
<td>29  42 1.00 0.83</td>
</tr>
<tr>
<td>25</td>
<td>69.9</td>
<td>10</td>
<td>.084</td>
<td>46    37 0.95 0.75</td>
<td>46  37 0.95 0.75</td>
</tr>
<tr>
<td>30</td>
<td>70.7</td>
<td>9</td>
<td>.080</td>
<td>68    30 0.95 0.69</td>
<td>68  30 0.95 0.69</td>
</tr>
</tbody>
</table>

1After emergence. 2Before crop maturity.
Fertilizing Proso Millet

By L. A. Nelson and L. A. Daigger

Proso millet production in western Nebraska has a lot of things going for it. Increased market prices for proso have made it more competitive with wheat. Excellent yields have been produced under continuous cropping, eliminating some of the expensive fallowing operations and producing twice as many harvested crops.

Many farmers are including proso in 3- and 5-year rotation systems. Less water is needed to produce proso than other commonly grown dryland crops, principally wheat and forage crops. Proso planted after wheat in a wheat-proso-fallow rotation is an excellent means of controlling or at least reducing infestations of downy brome and other winter annual weeds.

 Farmers using continuous proso and those planting proso after wheat in their cropping sequence often found the proso plants were small and pale green in color. Yields were lower than when proso was planted on fallow. Soil moisture was adequate to produce the crop so soil nutrient levels may have been limiting.

First Results

Fertilizer could improve nutrient levels, but what amounts and kinds of fertilizer are needed to produce top yields of proso? Our first investigations showed that nitrogen did not increase yields of proso that was planted after fallow. Nitrogen fertilizer at several rates were applied to proso on fallow in 1965 at two locations near Lorenzo, Neb. There were no increases in yields although plant growth on fertilized plots was increased. These findings were confirmed by other field trials.

A series of experiments was begun to determine the effects on yields when both nitrogen and phosphorus were applied under continuous proso production. Yields were increased by fertilization and were almost equal to yields of proso produced on fallow. However, increasing fertilizer cost required that only needed fertilizer be used. How much nitrogen fertilizer was needed for top production? Was phosphorus needed? What was the best means of determining the answer to these questions?

### Soil Tests

Soil tests have been one of the best tools available to predict fertilizer need. We established several trials to correlate soil tests with fertilizer needs. Early attempts were discouraging because of drought, hail, grasshoppers, late seeding and other factors that limited yields. Sufficient data have now been collected to verify some early findings.

Nitrogen as ammonium nitrate was broadcast on plots and worked into the soil before planting at two sites in 1970. The residual nitrate-nitrogen content of the top 2 feet of soil was 16 pounds per acre at location 1 and 15 pounds per acre at location 2. Data are presented in Table 1. At this location, 40 pounds nitrogen per acre seemed sufficient.

Soils vary in their nitrate content at the beginning of the season. The yield response expected depends on this content. To simulate different soil nitrate contents, ammonium nitrate was applied at rates of 0, 40, 80, 160 and 320 pounds of nitrogen per acre on 30- by 40-foot plots in March. Soil samples were collected before the proso was planted to determine the nitrate-nitrogen content of the individual plots. After the proso was planted, ammonium nitrate was broadcast across the plots at rates of 0, 25, 50, 75 and 100 pounds nitrogen per acre. The

<table>
<thead>
<tr>
<th>Nitrogen applied (lb/acre)</th>
<th>Proso Millet Yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>Location 2</td>
</tr>
<tr>
<td>0</td>
<td>7.0</td>
</tr>
<tr>
<td>40</td>
<td>12.8</td>
</tr>
<tr>
<td>80</td>
<td>14.8</td>
</tr>
<tr>
<td>160</td>
<td>15.1</td>
</tr>
</tbody>
</table>

Table 2. Proso yields as affected by five rates of nitrogen and 5 soil nitrate levels. 1972.

<table>
<thead>
<tr>
<th>Nitrogen applied (lb/acre)</th>
<th>Proso Millet Yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>Location 2</td>
</tr>
<tr>
<td>0</td>
<td>10.0</td>
</tr>
<tr>
<td>20</td>
<td>13.5</td>
</tr>
<tr>
<td>60</td>
<td>13.4</td>
</tr>
<tr>
<td>100</td>
<td>13.3</td>
</tr>
<tr>
<td>175</td>
<td>9.4</td>
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</tbody>
</table>

Table 3. Proso yields as affected by rate of nitrogen and 5 soil nitrate levels. 1972.

<table>
<thead>
<tr>
<th>Nitrogen applied (lb/acre)</th>
<th>Proso Millet Yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>Location 2</td>
</tr>
<tr>
<td>0</td>
<td>19.0</td>
</tr>
<tr>
<td>75</td>
<td>16.2</td>
</tr>
<tr>
<td>100</td>
<td>15.1</td>
</tr>
</tbody>
</table>

Table 4. Yields of proso as affected by phosphorus fertilization.

<table>
<thead>
<tr>
<th>Phosphorus Soil test level (ppm P)</th>
<th>Proso Millet Yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>Location 2</td>
</tr>
<tr>
<td>0</td>
<td>19.0</td>
</tr>
<tr>
<td>50</td>
<td>16.2</td>
</tr>
</tbody>
</table>

L. A. Nelson is Assistant Professor of Agronomy and L. A. Daigger is District Extension Specialist (Soils), Panhandle Station.
yields and nitrate-nitrogen in the top 2 feet of soil are shown in Table 2.

Soil samples were collected after harvest from each plot and residual nitrate-nitrogen determined. Rates of 0 and 40 pounds nitrogen per acre as ammonium nitrate was broadcast over the plots prior to planting in 1972. The results are shown in Table 3. Severe drought at the latter part of the growing season greatly curtailed yields where excess nitrogen had increased forage and depleted moisture reserves.

Results indicate that proso yields are increased only on those soils testing below 30 pounds nitrate-nitrogen per acre in the top 2 feet of soil. Data were also collected from nitrate-nitrogen measurements to the 6-foot depth but it was found that the 2-foot sample was adequate to predict nitrogen needs. It was concluded that 25 pounds N would give the most economical returns with current fertilizer and grain prices.

More Tests

Nitrogen and phosphorus were applied to proso fields having different phosphorus levels (Bray #1 P extract) and yields from these plots were determined. Seven locations were used in three years to determine at what soil test phosphorus level additional phosphorus should be added.

The trials also were designed to determine whether nitrogen and phosphorus are dependent on each other for response. Phosphorus (0-46-0) was broadcast before planting and worked into the soil. One-half of the plots received applications of 40 pounds nitrogen per acre as ammonium nitrate.

These data, shown in Table 4, indicate that phosphorus applied to soils testing 6 parts per million (Bray P-1) or above would not increase yields sufficiently to pay for the fertilizer. No interactions between nitrogen and phosphorus were detected which would indicate that a response to nitrogen, if needed, would not change with the addition of phosphorus.
Clockwise from above, Dr. Kurt Schallinger of Volcani Institute points out the use of liquid fertilizer and automated irrigation systems; Prof. Michael Evanari, in hat, discusses ancient systems of water harvest in the Negev Desert; Dr. Chesin and most of the group make a tourist stop at the Western Wall of the ancient Jewish temple in Jerusalem; students explore remains of the ancient Roman aqueduct at Caesarea.
A University of Nebraska group”Students See Agriculture in the Holy Land

By Leon Chesnin

Agronomy students get a firsthand look at farming in Israel, where water is scarce but ingenuity and determination are not.

Semester break at the University of Nebraska—a 3-week interim around the holidays—included a learning visit to Israel this past winter for 16 students, Associate Professor Leon Chesnin and Mrs. Chesnin. The group toured Israel to study crop production and soil management in a course for academic credit, Agronomy 402.

This course is one of several offered by the University of Nebraska in its Winterim Program for students and staff during the winter semester break. Participants fly on a University chartered plane to London or beyond for firsthand observation of the subject they are studying. The travel portion of these courses is preceded and followed by background reading, lectures and written assignments when appropriate.

The agronomy students were introduced to Israel's agriculture at a pre-trip dinner in Lincoln in November. Gideon Cohen, the Agricultural Counselor of the Embassy of Israel talked with the students about his country's agriculture and showed two films on its development from a primitive form.

Upon our arrival in Tel Aviv the class was met by Dr. Kurt Schallinger, Scientific Coordinator of the Ministry of Agriculture's Volcani Institute. Dr. Schallinger was assigned to be with our class and functioned as an important resource person in the classroom and on our many field trips.

During the first week, top level University and Ministry of Agriculture research specialists lectured to the group. They discussed the soils of Israel, their properties and agricultural use, the climate of the country and the advanced technology that Israeli farmers use every day in dryland farming and irrigation practices to increase the efficiency of water use.

Other specialists talked to the group about soil salinity problems; dryland farming, with emphasis on wheat and pasture production; soil and water management systems under irrigation in arid and semi-arid regions; and irrigation equipment.

On our field trips we observed that all irrigated farms had a standard meteorological evaporation pan. Using it, farmers could apply the exact amount of water lost by evaporation and used by the particular crop.

Israel's agriculture is based on efficient use of all its water resources. With an average cost of 16 to 35 cents per 1,000 gallons for the use of water in agriculture (compared to 1 to 6 cents in Nebraska), Israeli farmers have an incentive to avoid waste.

The effects of wise water use have been impressive. Trickle irrigation and fertilization of coastal sand dunes, consisting of 95 percent pure quartz with no nutrients, has resulted in yields of 80 tons of tomatoes per acre where nothing grew before.

At the International Symposium on the Use of Brackish Water in Agriculture, held in Beersheba, the class learned about ancient systems of agriculture in the Negev Desert. The class was given a guided tour of reconstructed ancient farms in the southern Negev where agriculture was carried on in the desert more than 2,000 years ago. Recent excavations at Avdat by Hebrew University archeologists date agriculture in the area to the Bronze Age, about 9,000 years ago.

(Continued on next page)
Holy Land...

Irrigation agriculture existed at this time in Jericho, where the class visited an experiment station which uses water from the very same ancient sources.

Field trips were taken to all the agricultural regions of Israel. The class visited the Kibbutz Sde Boker where the ancient water harvest systems of desert farmers has been applied to modern irrigation agriculture. Visits to other kibbutzim—Na'an, Ein Gedi, Sa'ad, Ayelet Hashchar—increased the students' understanding of the importance of cooperatives in the agricultural community of Israel.

Historic Landmarks

In connection with field trips or on tours, the class visited the holy places of Bethlehem, Jerusalem and Nazareth; the catacombs of Bet Shearim, King Herod's palace on Mount Massada by the Dead Sea, the Sea of Galilee (Lake Kinneret), and the Golan Heights with its volcanoes. We also visited the Jordan Valley, the Hula Valley with its peat soils, the Upper Galilee, the Bahai Temple in Haifa, the Roman City and Crusader Village at Caesarea, the Turkish fortress and Crusader Village at Acre and the Samaritan, Carmel and Judean Mountains.

At a special luncheon at Hebrew University in Jerusalem, the class heard a member of Israel's Ministry of Foreign Affairs explain Israel's cooperative programs to assist underdeveloped nations.

The class was impressed with the high level of technology in Israel’s agriculture, and the energy, determination, informality, friendliness and hospitality of the people. Each student received a certificate and a parting gift of a photo book of Israel from Dr. Schalling, host at the Volcani Center.

At the closing session of the class, held in London, we discussed the significance of practices observed in Israel and their possible use in Nebraska, particularly conservation of water.

While on an agricultural tour of the area, the University of Nebraska students pause to visit the Church of the Nativity in Bethlehem.