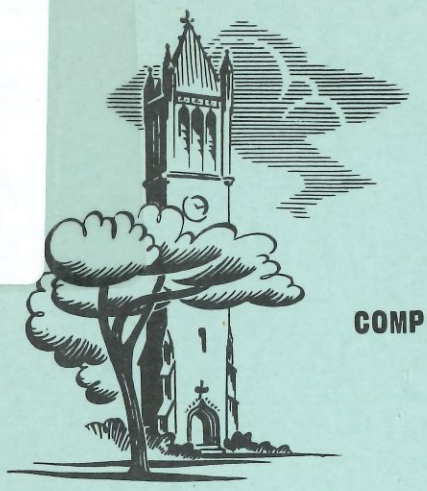

COMPETENCIES IN SOIL MANAGEMENT AND USE OF FERTILIZERS NEEDED BY FARMERS

William Clair Bennett, Jr.

Department of Education

and

Iowa Agriculture and Home Economics Experiment Station
Iowa State University of Science and Technology
Ames, Iowa

in cooperation with

Vocational Agriculture Section
Division of Vocational Education
State Department of Public Instruction
Des Moines, Iowa

This is an abstract of a thesis submitted to Iowa State University of Science and Technology by William Clair Bennett, Jr. in partial fulfillment of the requirements for the degree of Master of Science in August of 1965.

The study is one of a series conducted by the Department of Education of Iowa State University of Science and Technology with the assistance of graduate students in agricultural education in cooperation with the Iowa Agriculture and Home Economics Experiment Station and the Vocational Agriculture Section, Division of Vocational Education, State Department of Public Instruction.

This abstract was prepared by William Clair Bennett, Jr. with the assistance of Alan Kahler, research assistant for the Iowa Agriculture and Home Economics Experiment Station Project 1253, under the direction of Dr. Duane L. Blake.

COMPETENCIES IN SOIL MANAGEMENT AND USE OF FERTILIZERS NEEDED BY FARMERS

by

William Clair Bennett, Jr.

Purpose of the Study

This study was designed to determine the competencies that should be included in the training programs of present and prospective farm operators in the areas of soil management and the use of fertilizers.

Method of Procedure

A panel of 15 carefully selected agricultural leaders from six agricultural fields served as a panel of consultants in developing a list of 46 competencies needed by farmers in the areas of soil management and the use of fertilizers.

The final list of competencies consisted of 13 abilities and 9 understandings in the use of fertilizer, 14 abilities and 10 understandings in soil management. This list was included in a questionnaire and mailed to 314 farmers who had been named as outstanding farmers within their communities by the Iowa Junior Chamber of Commerce. The farmers evaluated the degree each competency was needed to succeed and the degree of each competency that they possessed. Data from the first 200 usable questionnaires that were received were used in the study. The outstanding farmers who responded were well distributed throughout Iowa.

Findings

Each of the 46 competencies was evaluated by the respondents by selecting a value rating on the basis of a ten-point scale. The rating was first made for the degree he believed the competency was needed, followed by the degree that he felt he possessed in the competency. Mean scores for needed competencies ranged from 7.05 to 4.09, while mean scores for possessed competencies ranged from 6.37 to 3.56.

The highest ranked competency for both the degree needed and degree possessed was the responsibility for maintenance of soil productiveness for future generations. The mean needed score for this competency was 7.05. The ranked mean scores for each of the other top ten competencies were as follows: (2) control of weeds and soil insects 7.00, (3) develop a farm plan for maximum use of soil resources 6.93, (4) economic principles in soil management 6.88, (5) balanced nutritional needs of crops 6.78, (6) safety in transfer of liquid and anhydrous 6.78, (7) fertilizer nutrients, grades and labeling 6.78, (8) plan an economical fertilization program 6.77, (9) proper use of fertilizer in good soil management 6.75, and (10) economic principles of fertilization 6.72. Other competencies are ranked in Table 1.

Table 1. Relationship of ranked mean soil management and fertilizer use competency scores needed and possessed by outstanding farmers

Competency	Needed[a]	Rank	Possessed[b]	Rank	Difference
Responsibility for maintenance of soil productiveness for future generations	7.05	1	6.37	1	.68
Control weeds and soil insects	7.00	2	6.19	3	.81
Develop a farm plan for maximum use of soil resources	6.93	3	5.72	14	1.21
Economic principles in soil management	6.88	4	5.76	11	1.12
Balanced nutritional needs of crops	6.78	5	5.33	27	1.45
Safety in transfer of liquid and anhydrous from bulk to applicator	6.78	6	4.72	38	2.06
Fertilizer nutrients, grades and labeling	6.78	7	5.61	17	1.17
Plan an economical fertilization program	6.77	8	5.62	16	1.15
Proper use of fertilizer in good soil management	6.75	9	5.97	5	.78
Economic principles of fertilization	6.72	10	5.51	20	1.21
Effect of leaching and placement on nutrient availability	6.68	11	5.03	35	1.65
Effect of cropping systems on erosion control, soil structure and soil loss	6.56	12	5.75	12	.81
Soil fertility as it is related to crop production	6.55	13	5.57	18	.98
Conservation practices and their value	6.50	14	6.03	4	.47
Match plant population to fertilizer	6.48	15	5.85	7	.63
Function of N, P, K, lime and manure	6.47	16	5.21	28	1.26
Establish a profitable crop rotation	6.41	17	6.29	2	.12
Soil development, characteristics and capabilities	6.40	18	4.82	36	1.58
Physical characteristics of fertilizer	6.40	19	4.47	40	1.93
How fertilizer reacts in the soil	6.38	20	4.48	39	1.90
Interpret soil test results	6.36	21	5.35	24	1.01
Use tillage practices correctly	6.34	22	5.86	6	.48
How sub-soil moisture and water use efficiency are affected by fertilization	6.32	23	5.03	34	1.29

[a]Degree competency needed: 0-1--None, 2-3--Little, 4-5--Some, 6-7--Much, 8-9--Very Much

[b]Degree competency possessed: 0-1--None, 2-3--Little, 4-5--Some, 6-7--Much, 8-9--Very Much

Table 1 continued.

Competency	Needed	Rank	Possessed	Rank	Difference
Relationship of tilth and organic matter	6.23	24	5.19	29	1.04
Help and funds available through ASC, SCS, Extension and Vocational Agriculture	6.21	25	5.79	10	.42
Calculate the best seasonal fertilizer buys on nutrient unit basis	6.19	26	5.17	30	1.02
Current sub-surface moisture conditions and crop effect on this moisture	6.19	27	5.36	23	.73
Maintain records of problem areas, soil type, depth of top soil and tile lines	6.15	28	5.06	33	1.09
Micro-elements, soil conditioners and organic fertilizers	6.11	29	3.59	45	2.52
Manage each field as a separate unit according to its soil capabilities	6.10	30	5.82	9	.28
Maintain individual field records of fertilization, yields and problem areas	6.10	31	5.34	26	.76
Properly time fertilizer applications	5.92	32	5.54	19	.38
Calibrate fertilizer spreader	5.89	33	5.72	13	.17
Maintain application equipment	5.85	34	5.13	31	.72
Establish and stablize grass waterways	5.85	35	5.34	25	.51
Determine slope and lay out contour lines	5.80	36	4.40	42	1.40
Establish terraces	5.68	37	3.56	46	2.12
Select methods of fertilization	5.67	38	5.66	15	.01
Maintain present tiling system	5.66	39	5.06	32	.60
Determine need for tiling	5.62	40	5.39	21	.23
Set up field test strips for seasonal growth and yield comparisons	5.60	41	4.76	37	.84
Operate machinery over terraces	5.59	42	3.92	44	1.67
Renovate permanent pasture	5.33	43	4.45	41	.88
Take an accurate soil sample	5.27	44	5.83	8	-.56
Calculate best limestone buys	5.29	45	4.29	43	1.00
Use temporary fence in management of crop land	4.92	46	5.37	22	-.45

The highest ranked possessed competencies and their mean scores were: (1) responsibility for maintenance of soil productiveness for future generations 6.37, (2) establish a profitable crop rotation 6.29, (3) control weeds and soil insects 6.19, (4) conservation practices and their values 6.03, (5) proper use or fertilizer in good soil management 5.97, (6) use tillage practices correctly 5.86, (7) match plant population to fertilizer 5.85, (8) take an accurate soil sample 5.83, (9) manage each field as a separate unit according to its soil capabilities 5.82, and (10) help and funds available through Agriculture Stabilization and Conservation Commission, Soil Conservation Service, Extension Service and Vocational Agriculture 5.79. The top ten competencies were within a range of .94, from a mean score of 6.73 to 5.79.

The lowest ranked mean needed competencies and their mean needed scores were: (37) establish terraces 5.68, (38) select methods of fertilization 5.67, (39) maintain present tiling system 5.66, (40) determine need for tiling 5.62, (41) set up field test strips for seasonal growth and yield comparisons 5.60, (42) operate machinery over terraces 5.59, (43) renovate permanent pasture 5.33, (44) take an accurate soil sample 5.27, (45) calculate best limestone buys 5.29, and (46) use temporary fence in management of cropland 4.92.

The competencies with the lowest mean possessed scores were: (37) set up field test strips for seasonal growth and yield comparisons 4.76, (38) safety in transfer of liquid and anhydrous fertilizer from bulk storage to applicator 4.72, (39) how fertilizer reacts in the soil 4.48, (40) physical characteristics of fertilizer 4.47, (41) renovate permanent pasture 4.45, (42) determine slope and layout contour lines 4.40, (43) calculate best limestone buys 4.29, (44) operate machinery over terraces 3.92, (45) micro-elements, soil conditioners and organic fertilizers 3.59, and (46) establish terraces 3.56.

A product moment correlation matrix was tabulated for the 46 needed competencies to determine the extent to which changes in one competency were accompanied by changes in another competency. Those found to be most highly correlated were: determine need for tiling and maintain present tiling system; control weeds and soil insects and proper use of fertilizer in good soil management, establish terraces and develop a farm plan for maximum use of soil resources; use tillage practices correctly and control weeds and soil insects; and conservation practices and their value and effect of cropping systems on erosion control, soil structure and soil loss.

Another product moment correlation matrix was set up to determine the correlations that existed among the 46 competencies possessed. Highest correlations for possessed competencies were found between the understanding of physical characteristics of fertilizer and how fertilizer reacts in the soil; determine the need for tiling and maintain present tiling system; conservation practices and their value and the effect of cropping systems on erosion control, soil structure, and soil loss; establish terraces and operate machinery over terraces.

A comparison of the ten most highly ranked needed competencies and control variables resulted in three being significantly correlated at the one percent level. They were: educational level of the operator and the economic principles of fertilization; gross income, $10,000 increments and balanced nutritional needs of crops; and educational level of operator and plan an economical fertilization program.

Significant correlations between the ten high ranked needed competencies and the control variables at the five percent level were: educational level of operator and develop a farm plan for maximum use of soil resources; acres operated and control of weeds and soil insects; acres operated and balanced nutritional needs of crops; gross income, $10,000 increments and safety in handling of liquid and anhydrous fertilizer; acres operated and economic principles of fertilization; educational level of operator and control of weeds and soil insects; gross income $10,000 increments and proper use of fertilizer in good soil management; gross income, $10,000 increments and economic principles of fertilization.

Additional information from the questionnaires received from the outstanding farmers indicated the group had a mean gross income of $42,150 and a mean farm size of 394 acres. The median gross income of $33,178 and the median farm size of 357 acres were considerably smaller than the mean figures due to several large farm operations that varied greatly from the normal. The mean figures for owning and renting land were 164 acres owned and 129 acres rented. The mean corn acreage for the group was 154 acres. An increase in farm size was highly correlated with an increase in corn acres, acres rented, and gross income.

Of the 200 outstanding farmers, 53 percent had been enrolled in one or more years of vocational agriculture. A high percentage of the farmers who had taken vocational agriculture were found in the higher corn acreages and income ranges. Twenty-nine percent of the farmers reported more than 12 years of education. Those reporting an educational level of 13 to 14 years were located within higher corn acreage groups and within higher gross income ranges than those having additional years of education.

Of the outstanding farmers, 168, or 84 percent, rented additional land for their farming program. The rental agreements were reported as being 23 percent cash rent, 55 percent grain share and 22 percent livestock share. In a comparison of the number of years farmed to gross income it was observed that 83 percent of the farm operators had been farming from 7 to 18 years. As gross income increased to the $70,000 range, the modal group of farmers had been farming from 13 to 18 years. Above the $70,000 income group, the operators who had farmed 4 to 12 years became the modal group.

Implications

The need for additional training for present farm operators is evident when the outstanding farmer group that was studied indicated a need for more competence than they possessed in 44 to the 46 competencies that were identified and evaluated.

Educational programs for training present and prospective farm operators should be planned to include some training in all of the competencies that were identified in this study, with major emphasis being placed upon those competencies that were most highly evaluated. Existing programs of vocational agriculture for high school students, young farmer and adult farmer programs, cooperative extension programs, area vocational training schools and instructional programs in the College of Agriculture should be planned to provide for the needs of the communities and the personnel who will provide instructional training.