Soil Fertility Evaluation of Private Farms: Provides Students With Hands on Learning Experience

Adam Khan

Abstract

To increase retention of information by the students and also improve their teamwork, leadership, problem solution, and public relations skills at Missouri Western State College (MWSC), projects on soil fertility evaluation of private farms were initiated and carried out during 1985-1993. As part of their assignments, the students established annual records on each farm, analyzed the soil samples for available nutrients, evaluated the fertility status, and made the final recommendations.

The projects provided a structure for students to apply the fertility information they received during their classroom instruction, which subsequently increased their retention. The projects also improved their teamwork, leadership, problem solution, and public relations skills.

Introduction

Projects designed for hands on experience in soil fertility provide an opportunity for students to:

a. learn more than we plan to teach.
b. increase their retention of the material.
c. develop their teamwork, leadership, public relations, and problem solution skills (mega skills).

In addition, these projects create interest among students for the subject matter taught in a soil fertility class, which subsequently leads students to read textbooks, other books, journals, and magazines.

Moreover, hands on projects make students aware of the long term value of the material which is presented in a class. They are, therefore, likely to retain it longer (Bruner, 1963). College students generally find it difficult to retain information they receive during classroom instruction (Maurer, 1975). Learning subject matter through hands on projects, on the other hand, may result in enhanced learning and higher retention. (Kubiak et al., 1988 and Vogelsang et al., 1989)

Khan is a professor of agronomy, Department of Agriculture/ Agronomy, Missouri Western State College, 4525 Downs Drive, St. Joseph, MO 64507. A contribution from MEY Soil Testing Laboratory.

Occasionally, the students face problems while pursuing these hands on projects on soil fertility and therefore they have to learn problem solving techniques.

Additional benefits of out of class, hands on soil fertility projects include teamwork and public relations skills, which students might acquire. Many of the tasks in these projects require teamwork and sometimes public relations. Trede et al. (1992), for example, concludes that hands on projects provide valuable experiences relating to interpersonal relationship, including team work and leadership, for agricultural graduates.

Objectives

To describe the effects of hands on projects (soil fertility evaluation of private farms) on learning, retention and mega skills of students at MWSC.

Description of the Projects

The hands on projects on soil fertility evaluation were pursued each spring semester, during 1985 - 1993, on private farms. Eleven farms selected were owned by the students one by a local farmer, and one was owned by an alumnus of Missouri Western. Three groups: Soil Fertility class, Soil Fertility Special Project class, and MWSC Agronomy Club were involved in these projects each year. The students (about 25) were from both rural and urban areas. The projects were part of the curriculum for those who took Soil Fertility and Special Project classes and optional for the others.

The projects were planned through brain storming sessions under the supervision of the faculty. Then, ideas were generated in these sessions to establish the goals and objectives of the projects. Once the goals and objectives were defined, the students were provided with the soil survey books which included the aerial photographs and description of the project farms.

During the planning sessions, the students compiled the past 5 years of crop history, including fertilizer and pesticides use, and crop yield. They were also asked to enlarge the aerial photos of the farms and to draw field boundaries of each farm on a transparency.

After the planning sessions, the students divided each farm into sampling units using terrace lines, color of the soil, soil series map, and other observations and gave a number to each

unit. A team of volunteers consisting of 5-10 students collected soil samples from each unit. The samples were air dried, ground to pass through a 2 mm sieve, and analyzed at Missouri Western's MEY (maximum economic yield) Soil Testing lab for organic matter content (O.M.), pHs, and available P, K, Ca, and Mg using the following procedures (Khan, 1990):

Soil Test	Procedure
O.M.	Colorimetric
pHs	0.01 M $CaCl_2$
pHb	Woodruff Buffer
P	Bray P1
K, Ca, Mg	Ammonium Acetate

Fifty percent of the cost of testing was paid by the farmers and the rest by the MEY Soil Testing Lab.

Fertilizer and lime recommendations were initially made using computerized programs and then manually by the students so that they could learn the equations used in making these recommendations.

To evaluate the fertility levels, separate farm outline maps were prepared for each test, with each sample unit color coded to identify it with the test levels such as: "very low, low, medium, high, very high, or extremely high". Farm outline maps indicating the boundaries of soil series were also color coded to show the extent of each soil series. Soil orders, suborders, great groups, sub groups, and families of each soil series were identified. The detail taxonomic description of each soil series on each farm was also included in the final report.

The data collected on each farm was discussed among students to make the final recommendations. The recommendations along with the data were then condensed and presented in the form of a book on each farm to each farmer. About 2,338 hectares and 37 soil series in Andrew, DeKalb, Gentry, Atchison, Monroe, Shelby, Caldwell, Buchanan, Clay, Holt, Mercer, and Doniphan counties of Missouri and Kansas were evaluated over an eight years period. Location, acreage, and soil series of each project farm is given in the following Table.

Effect of the Project

Each project provided significant opportunities for students to apply the information they acquired during their classroom instruction. For example, through the projects, they learned soil sampling, sample processing, extraction, analysis, interpretation, and fertilizer recommendation. They also applied many fertility concepts such as the principle of limiting factors, P and K build up, hidden hunger, cation exchange, and nutrient mobility. Consequently, they were motivated to read, discuss and interact.

In addition, the projects provided sufficient structure to tie the maximum economic yield with soil testing, nutrient uptake, fertilizer application, and various plant growth factors (the topics covered in classroom instruction). Such information is less likely to be forgotten (Bruner, 1963; Heath, 1981).

It is interesting to note that interest in certain topics in soil fertility generated discussion among the participants, which resulted in innovative thinking and idea generation dealing with the project, and subsequently lead to interac-

Location and Description of each Project

Project	Hectares	Counties	Years	Soil Series	*# of samples*
Schnitker Farms	364	Andrew Dekalb Gentry	1985-86	Ken*, Zo, Sh, Arm, La, Ga	89
Garst Farm	462	Atchison	1986-87	Al, On, Ha, Gra, Sar, Sal	69
Saunder Farm	421	Monroe Shelby	1986-87	Au, Ch, Gi Kes, Le, Me, Pu	42
Richmond Farm	32	Caldwell	1987-88 La, Lam	Co, Gr, Ken	18
Finch Farm	267	Caldwell	1987-88	Ken, Zo, Ne, Co, Lam, La, Gr, Arms, Ad	68
Reed Farm	73	Caldwell	1987-88	Ken, Ne, Co, Zo, Mon, Arms, Lin	13
Winholtz Farm	65	Caldwell	1987-88	Arms, Lin, Gr, La, Ad, Zo	12
Waller Farm	54	Buchanan	1988-89	Cont, Mar, Gas Fla	9
Bailey Farm	81	Clay	1988-89	Arms, Nod, Sha	18
Hegarty	41	Doniphan	1988-89	Kn, Mar	19
McManus	364	DeKalb	1989-90	Zo, Lam, Sh	89
Polaski Farm	94	Holt	1990-91	Ca, Wa	12
Ward Farm	20	Mercer	1991-92	Nod	50
Foot Ball Farm	0.4	Buchanan	1992-93	Colo	128

*Abbreviation:Ken=Kennebec, Zo= Zook, Sh=Shelby, Arm=Armstrong, La= Lagonda, Ga=Gara, Al=Albaton, On=Onawa, Ha=Haynie, Gra=Grable, Sar= Sarpy, Sal=Salix, Au=Auxvasse, Ch=Chariton, Gi=Gifford, Ad=Adair, Kes=Keswick, Le=Leonard, Co=Colo, Gr=Grundy, Lam=Lamoni, Ne=Nevin, Arms=Armster, Mon=Moniteau, Lin=Lineville, Me=Mexico, Pu=Putnam, Cont=Contrary, Mar=Marshal, Gas=Gasonade, Fl=Flaggy, Nod=Nodaway, Sha=Sharpsburg, Ca=Cass, Wa=Wabash, Kn=Knox.

tion with the faculty. This interaction between faculty and students resulted in further learning and allowed for the continual application of educational principles. Similar observations were reported by Henderson (1988).

In fact, a higher level of retention was observed during discussion sessions where the students were able to recall the information they gained through classroom instruction. They were observed to be very active learners and, therefore, they learned more on soil fertility than was originally expected.

The private farms projects also provided an opportunity for students to learn skills such as teamwork and leadership. For instance, the projects were carried out by three different groups (Soil Fertility class, Special Project class, and Agronomy Club) and required a lot of coordination, teamwork, and leadership to process samples, map fields, collect and interpret data, and write reports. But, they successfully accomplished these tasks through team-work and planing which subsequently sharpened their leadership skills. Similar observations were reported by Maurer and Hall (1984) who observed that a practical learning experience project dealing with manufacturing and selling poultry products provided leadership, salesmanship, and good time to students. They also reported that their project provided an excellent opportunity for student-faculty interaction. Similar observations were also reported by Russell and Vandepopuliere (1977), Pautz ad Voitle (1980). Bird and Arrington (1980), and Hamre and Zarcher (1981).

Moreover, while working with farmers to collect data on crop history, fertilizer, pesticides, and economics, the students also learned public relations and problem solution skills. For example, in many instances, even though they were faced with problems that did not have clear answers, they were successfully able to solve these problems through discussion, interactions, and extensive reading.

Furthermore, While pursuing a project, the objectives of teaching facts in the classroom were seen by the students to solve problems rather than to simply learn facts. Such information brought greater personal satisfaction to students (Miller, et al., 1962; Blair, et al., 1975).

Soil fertility projects also provided significant information for management decisions and were instrumental in convincing the farmers to establish records and to pursue regular soil testing.

Projects in soil fertility are especially beneficial to students with urban or non-farm background. They provide them the opportunity to see the application of soil fertility concepts in real farming situation. In fact, the hands on projects are becoming more important in recent years since large number of students enrolling in agriculture colleges have little or no field experience (Miller, 1977; Dunkelberger and Molns, 1980; Hasslen, 1983).

Conclusion

Hands on projects on soil fertility evaluation of private farms pursued by the students, increased their learning, retention and skills such as leadership, problem solution, and public relations.

References

Bird, H.R. and L.C. Arrington. 1980. Class demonstration of nutrition deficiencies in chicks. *Poultry Science 59*:1583 (abstr.).

Blair, J.M., R.S. Jones, and R.H. Simpson. 1975. *Educational Psychology*, 4th ed. Macmillan Publishing Co. Inc., New York.

Bruner, J.S. 1963. *The Process of Education.* Vintage Books, New York.

Dunkelberger, J.E. and J.J. Molns. 1980. Agronomy students at southern land grant universities. *J. Agron. Educ.* 9:36-46.

Hamre, M.L. and T.D. Zurcher. 1981. Using project meeting guides to teach 4-H poultry subject matter. *Poultry Science 60*:1667 (abstr.).

Hasslen, H. 1983. How are agriculture colleges responding to needs of non farm students? *J. Agron. Educ.* 12:4-5.

Heath, T. 1981. What is the relationship between what the teacher teaches and what the learner learns? *Journal of Veterinary Medical Education* 8(2):43-46.

Henderson, J.L. 1988. Ways to encourage student learning. *The Agricultural Education Magazine* 60(9):19-20.

Khan, Adam. 1990. *MEY Soil Testing Lab. Training Manual.* MEY Soil Testing Lab. Saint Joseph, Mo.

Kubiak, J.R., J.W. Evans, and G.D. Potter. 1988. A hands on foaling management laboratory for a senior level horse production course. *NACTA Journal.* 32(1):42-44.

Maurer, A.J. 1975. Hard-cooking and pickling eggs as teaching aids. *Poultry Science 54*:1019-1024.

Maurer, A.J. and M.A. Hall. 1984. Manufacturing and selling poultry products as a student learning experience. *Poultry Science 65*:601-603.

Miller, D.G. 1977. Changing students composition in the plant sciences. *J. Agron. Educ.* 4:15-20.

Miller, G.E., S. Abrahamson, I.S. Chen, H.P. Graser, R.S. Harnack, and A. Land. 1962. *Teaching and learning in medical schools.* Harvard Univ. Press, Cambridge, Mass.

Pautz, R.K. and R.A. Voitle. 1980. The poultry enterprise system: A "hands on" approach to teaching. *Poultry Science* 59:1649 (abstr.).

Russell, W.D. and J.M. Vandepopuliere. 1977. Sale of fresh dressed turkeys as a learning experience and a money making club activity. p. 63. In Poultry Science Association's 66th annual meeting's abstract of papers.

Trede, L.D., F.M.Soomro, and D.L. Williams. 1992. Laboratory farm based course meets content and teaching procedures. *NACTA Journal.* 36(4):21-24.

Vogelsang, M.M., S.P. Webb, and G.D. Potter. 1989. A hands on method of teaching horse training skills to students of varying levels of experience. *NACTA Journal* 33(2): 45-47.