Management team analysis of crop production systems: A course in problem identification and resolution

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ABSTRACT

Undergraduate students in agriculture generally receive excellent training in the specific topic areas necessary to build professional competency. Education in the integration of this knowledge to solve multifaceted problems and to articulate recommendations in a persuasive manner, however, has not been a part of traditional course offerings. This paper reports the organization of a course that provided the opportunity for students to gain experience with cropping system analysis and problem-solving. Students worked in teams to identify profit-limiting factors on operating grain farms and to establish management priorities. They developed recommendations to resolve the management problems and presented them to the cooperating producers. Emphasis was placed on student interaction and cooperation within small groups both on-site and in discussion on campus. Students were encouraged to use a wide variety of resources to accomplish their objectives. Students responded positively to this teaching approach. They commented that this course provided a useful opportunity to integrate and apply knowledge gained from a variety of sources. All of the respondents rated this course “best” when asked to compare it with their other courses.

Additional index words: Group interaction, Problem solving.

One objective of higher education is to teach students to analyze information from many sources and synthesize ideas in a variety of situations (Haning, 1982). Traditional classroom instruction effectively supports students in the acquisition of topic-specific knowledge but often leaves the integration of knowledge and its broad application to training on the job. Most schools of agriculture offer opportunities for supervised cooperative and internship assignments (Olson, 1980). Although such opportunities provide valuable experience, they often build skills in specific areas of endeavor such as plant breeding or the testing of agricultural chemical performance. They do not offer broad decision-making experience in crop management systems.

A number of problem-solving classes have been successfully organized to further develop student understanding of prior coursework through practical problem-solving. Howell et al. (1982) developed an advanced course in problem-solving with emphasis on tropical agricultural systems. Student teams visited farming operations in Puerto Rico where they interacted directly with farmers and extension agents in evaluating management practices. Gray (1978) worked with student teams that were challenged to map soils for cooperating landowners. Student teams in that class presented their work for review both by the landowners and by professional soil scientists. Haning (1982) promoted interdisciplinary activity and communication through a problem-solving course that required student teams to develop integrated pest management plans for existing farming systems.

Two characteristics were key to each of these problem-solving courses. First, students were encouraged to work with actual problems in realistic settings, and they were provided with the appropriate resources required to complete their assigned task. Howe and Durr (1982) reported that concrete operational thought employs real objects, situations, and experiences. They concluded that students need experience with real objects to think about and fully understand higher-level concepts. Second, students worked together in small groups to accomplish their objectives. Peer interaction enhances learning by the individuals in small groups through several means. Interaction induces cognitive conflict or causes students to challenge previously held ideas and assumptions (Howe and Durr, 1982). Through cognitive conflict learning is enhanced as incomplete understanding is replaced by more complete understanding. Other workers have reported that small group interaction improves student achievement by encouraging students to solve problems in a wider variety of situations than is otherwise possible when students work individually (Wittrock, 1974; Myers and Lamm, 1976; Johnson and Johnson, 1979). Buckholdt and Wodarski (1978) reported superior performance of students working in interactive small groups. Their research indicated that students were more able to understand and therefore respond to the verbal and non-verbal cues of their peers than those of professional teachers. Their research also indicated a lower level of anxiety in students learning from other students in a group than that of students learning from a teacher directly. Slavin (1977) noted that feedback and the sharing of resources among students in small groups helped the students to reshape their ideas and to learn information they might not have otherwise discovered through independent study.

This paper reports the organization of a course designed to encourage students to solve actual crop production problems through work in small, interactive groups.

COURSE DESCRIPTION

Nine seniors in Agriculture were enrolled in Advanced Crop Production Systems as a 2 credit-h special problems course. Two of the students had extensive experience in operating a grain farm. The remaining students had little or no prior practical experience with grain farm management.

1 Contribution from the Dep. of Agronomy, Purdue Univ., West Lafayette, IN 47907.
2 Assistant professor, Dep. of Agronomy, Purdue Univ., W. Lafayette, IN 47907.
The mutual support demonstrated by these students was consistent with that reported in other small-group learning environments (Wittrock, 1974; Myers and Lamm, 1976; Slavin, 1977; Johnson and Johnson, 1979; and Howe and Durr, 1982). Class meetings were held weekly during the semester with 1 h for a discussion of progress and problems among all students and with an average of 2 h additional for specific planning and discussion within each team. Site visits were generally made on weekends or during evening hours. The course instructor accompanied team members on each site visit. An agenda was prepared by the students before each site visit to optimize the use of time on location. Three to four site visits were made by each management team. On-site data collection, farmer interviews, and outside research focused upon a wide range of topic areas. Outside research included extensive reading and interaction with the staff at local SCS and ASCS offices, a professional crop consultant, farm chemical and fertilizer suppliers, farm equipment dealers, the clientele of a rural coffee shop, the families of each cooperater over Saturday morning coffee and Sunday evening dinner, and a number of teaching, extension, and research faculty in Agronomy at Purdue University. Data collection, interpretation, and cropping system recommendations included several topic areas mentioned below.

**Soil and Water Management**

1. Mapping and description of soil types including estimates of yield potential and soil water-holding capacity.
2. Soil fertility and pH (specific recommendations for fertilizer and lime application were tailored for areas of each field as appropriate; costs were also projected).
3. Rooting depth and distribution (notes based upon shallow excavation).
4. Soil drainage (as indicated by soil mottling).
5. Soil compaction, as observed by penetrometer readings and knife tests in three-sided pits. Reduced traffic, improved drainage, and expanded crop rotation were among the recommendations.
6. Location and severity of sheet, rill, and gully erosion. Recommended improvements included the seeding of a winter cover crop and coulter-planting or contoured chisel plowing as appropriate and the installation of grassed waterways to SCS specifications where required.

**Plant Factors**

1. Soybean and wheat cultivar, and corn hybrid selection. Recommendations were specific for proposed tillage and planting systems and based upon performance trials; specific procedures for the initiation of on-farm cultivar and hybrid performance trials were also presented.
2. Planting date. Discussions of yield response and the constraints imposed by drainage and by tillage choice were included.
3. Row width. Recommendations included drill-row soybean production as documented by cost/benefit projections.

4. Plant population. Established plant populations were measured. Specific reference to planting date, row width, and cultivar or hybrid selection was included in recommendations.

5. Stand uniformity. Variation in stand was measured for corn with specific recommendations made for improved precision where appropriate.

6. Lodging potential. The selection of optimum combinations of cultivar, planting date, population and row width was discussed with emphasis on maximum production with minimum field losses.

**Pest Management**

1. Insect scouting reports. Scouting reports included an assessment of insect populations and feeding damage encountered.

2. Plant disease problems. Crop condition was evaluated for pathogen problems. Crop rotation was discussed with regard to areas where no-till planting was recommended.

3. Weed pressure. Weed species and their population density were mapped and target-specific herbicide programs were composed.

**EVALUATION**

The students were asked to evaluate the course following its completion. The results of this evaluation are summarized in Table 1. The most commonly cited benefit was that this approach to learning provided a useful means of integrating previous course material and of applying it in a meaningful way. This comment was particularly interesting in that five of eight students polled at the beginning of the course responded that a lack of experience in the application of agronomic information was their greatest weakness as professional agronomists. The other three students noted their respective professional limitations prior to this course as limited technical background, little experience in making complex decisions in an organized manner, and a lack of confidence in communicating with large groups of people.

We also evaluated student accomplishment of the stated behavioral objectives. Each student was an active participant in discussions with the cooperating farmers and maintained an effective working relationship with them. Mutual confidence increased so that the farmers allowed the students open access to farm and financial records. Each student contributed to a 40-to 60-page written report that presented detailed observations and recommendations organized by field and by commodity. Each student also contributed to extensive slide and videotape documentation of the reports and to an oral presentation to each farmer.

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**Table 1. Student evaluations of the course in crop production system analysis. Five students were surveyed 1 year after they had completed the course.**

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<th>1. What was the greatest benefit you derived from this course?</th>
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<td>“This course did more for my overall professionalism than did any seminar or writing course I have ever had because it is a culmination of things learned in school.”</td>
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<td>“The course provided a chance to actually observe problems in the field and recommend a solution to correct the problems. Justifying the recommendations was necessary and supplied the most benefit to me.”</td>
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<td>“There were two major benefits from this course. First, the opportunity to apply what was learned in class. The second major benefit would be working as a group, voicing our own opinions, and listening to others in analyzing the farm as well as putting together a major report on our work.”</td>
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<td>“The greatest benefit was increased verbal and written communication skills. Also, I gained a lot of self-confidence from this course.”</td>
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<td>“The greatest benefit I found from this course was that it helped tie together the material I had learned over the past 4 years. It allowed me to use this knowledge in a real situation and gave me some excellent hands-on experience.”</td>
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2. Would you recommend that this course be taught again? If so, to whom?

“Yes. This course should be offered to first or second semester seniors. This would allow for optimum learning relative to past classes and experience. Students who have a good background will make use of information from classes and focus on the result of (input) interactions on the farm.”

“Three hours. There is a lot of research involved with development of the course material. They should be made aware of the extra time required (weekends, nights, etc.) and the need for a flexible schedule to meet with their group.”

“Three hours. There is a lot of research involved with developing the summary paper after the field work is completed.”

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3. How many credit hours do you feel should be associated with this course if it is to be taught again?

“At least two and most likely three. This course is extensive both in thought and preparation.”

“Personally, I gained just as much if not more in this class as in two semesters of cooperative (industry internship) work.”

“This could be a three-hour course.”

4. Please rate this course in comparison to other undergraduate courses you have completed at Purdue.

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<th>Poorest</th>
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All five respondents indicated “best” with a ranking of 1.

5. Please feel free to make any additional comments.

(The response of one student is representative of the others.)

“In several classes people try aimlessly to motivate students to do in depth professional work but what does a student have to compare his/her work to? Most students have never had the chance to be responsible for their work at a depth that this class provided. Students must learn to interact with a farmer, to think, and to apply knowledge. They must learn to work both as a team member and as individuals, and to present and sell their ideas in a professional manner. These are all things they must do when they begin their careers so why shouldn’t they be well prepared and be ‘one up’ on others competing for similar jobs? This one class could be one of the best selling tools for our students in interviews as well as for the university when employee evaluations come back. Everyone benefited from this class, including the farmer, the students, the professor, and the university. I’m grateful that I had the opportunity to be a part of it.”
University administrators, extension and teaching faculty, graduate students, and other undergraduate students also attended these presentations.

Farmer comments regarding the consulting work done by the students have been positive, and both farmers responded to the student’s observations. Follow-up interviews indicated a number of substantial management changes based upon their recommendations. Examples of these changes include transition to no-till corn planting in soybean residue vs. previous chisel tillage, increased precision in soil sampling and soil fertility management, improved herbicide selection and application, and decreased soybean row width (from 0.97 m to less than 0.40 m).

The course, though taught only once to date, continues to return dividends. The detailed information and observations these students collected for approximately 240 ha now provide a realistic resource base for small-scale decision-making projects in use by a grain crop production class of over 125 students each semester. Enthusiasm has remained high among the nine students who participated in the original special problems course. Seven of the alumni of this course gathered to share their experiences with teaching faculty and with other students at the resident education sessions of the meetings of the American Society of Agronomy in 1985 (Peacock et al., 1985; and Schweitzer et al., 1985). Though requiring a substantial investment of teaching time, the direct and indirect benefits of the management team approach are numerous as students build their professional equity in an exciting and meaningful way.

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REFERENCES


