Coffee growers make improved pest management decisions through group learning and experimentation by crop stage

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Farm families attempting to produce a profitable crop with available resources face conditions of variability and uncertainty in their planning and decision-making. Rainfall follows a yearly pattern, but the same month in successive years often varies 3-6 fold or more in rainfall. This variability affects crop vigor and phenology, pest levels, and the effectiveness of cropping practices. Farmers, however, do not know which months will be above or below average when they plan their cropping activities. To plan for the upcoming cropping season, farmers have several sources of information, even though these sources may be incomplete and uncertain: experience accumulated from previous seasons, their neighbors' experiences, specific data about each different field, expectations about prices, resources, and weather, and technical recommendations from extension. Their plan for the new season is often a minor variation on a routine developed over time in response to the local conditions (Aubry, Papy, & Papillon, 1998). As the period nears to initiate field work, farmers modify their decisions based on additional observations and information about the season. The advancing season brings new information and observations. In response farmers adjust their expectations and decisions again and again. With the end of the crop cycle, farmers begin to think about the next year with one more season of experience.

Programs for technology transfer are based on recommendation domains (CIMMYT 1980). Scientists develop general recommendations for the average conditions across several years in each domain. Extensionists use demonstration plots and field days to convince farmers to use improved practices. General training is often done in the off-season when farmers have more time for extended classroom lectures. This approach has contributed to increased crop yields in favored environments and among favored farmers. However, input overuse has produced environmental pollution and economic inefficiency. In less favored environments and among less favored farmers yield increases have been modest or irregular. The challenge to agricultural science that this represents is how to strengthen farmer management of variability and uncertainty. On the one hand, scientists need to build year-to-year ecological variability into their research programs. In the case of pest management, Guharay, Monterroso, and Staver (1999) have proposed a food web analysis by crop stage to incorporate variability into research design. A participatory research component strengthens scientific understanding of farmer management of variability (Biggs 1989). On the other hand, technology transfer programs need to be refocused on farm family decision-making capacity. Choice of practices, the timing in their use, and the combination of practices are important skills in crop management under conditions of variability and uncertainty. This paper describes a group participatory training approach by crop stage to strengthen coffee farmer abilities to observe and analyze crop health, pest incidence, and shade level and distribution and to make improved decisions. This approach, developed by the CATIE IPM Project in Nicaragua with financing from NORAD in conjunction with collaborators from the Nicaraguan Coffee Growers Association

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(UNICAFE), the National Agrarian University, and numerous NGOs, has been field tested with groups of coffee growers and extensionists throughout the coffee zones of Nicaragua.

The training process has a number of characteristics. First, groups of farmers come together to share their experiences, what they have observed and what they have tried, to analyze their current situation and prioritize their problems, and to propose alternatives for testing. Group debate, dialogue, and exchange of ideas generate motivation and promote creativity. Data collection and group discussions among 10-25 farmers focuses management issues on the variability among practices and outcomes. Second, meetings are held in the field where growers feel more comfortable and where living study materials, weeds of different types, insects, damaged coffee leaves or fruits, abound. Third, the dialogue with growers incorporates biological and ecological concepts which draw on what they have observed and can observe. This dialogue based on inductive questioning strengthens their ability to analyze why pest problems vary within fields, from field to field, and from year to year. The field technician acts as facilitator of the dialogue incorporating participatory field exercises and data which growers bring from their own fields to fill in gaps in the group's knowledge. Fourth, the dialogue is organized to link what growers know and have observed to the decisions they make and the practices they use in pest management. Making decisions and carrying them out in a timely fashion is emphasized. At the end of each session growers agree to take data in their fields and try different practices which they report on in the following session. The field technician may also describe alternative practices with which the group is not familiar. Fifth, several farmers volunteer to carry out season-long test plots to compare their normal practices with alternative practices. Lastly, the training sequence follows a seasonal schedule which coincides with the major crop stages and decision-making moments during the yearly coffee cycle (Figure 1). As a perennial crop, the yearly cycle in coffee varies. Whether the crop is in the nursery, recently established, at peak production, or in decline, critical moments can be identified. Typically six meetings throughout the year are sufficient to cover these key moments.

For each of the pests shown in Figure 1 scientists in the CATIE IPM/INTA Program in Nicaragua have developed participatory training methods which build on farmer knowledge and experience, promote analysis of the causes of variability from field to field and season to season, and relate observations to management decisions (CATIE, no date-a,b). The role of shade and tree management in pest incidence is analyzed in each session.

In coffee berry borer, growers first discuss what they know and how they learned about the pest. They then identify what they would like to learn. Often among all the members of the group there is enough information to lay out the insect's life cycle. The facilitator brings along preserved specimens of each life stage and a hand lens. The group then moves to a nearby field to look for the insect and to observe and collect biological control agents of the borer, including spiders, ants, and fungus. In the last session of the day the extension agent works with the group to analyze where the berry borer is at the different phenological stages. Using colored pencils and a small workbook the farmers draw coffee fruits in six crop stages and discuss where the borer is and what factors affect it. In the last page in the workbook farmers write or draw their own management plan. In farmer meetings later in the season, farmers learn to count the pest and analyze how and when to use different practices like gleaning fallen fruits or harvesting the first damaged fruits before the insect emerges into the main fruit set.

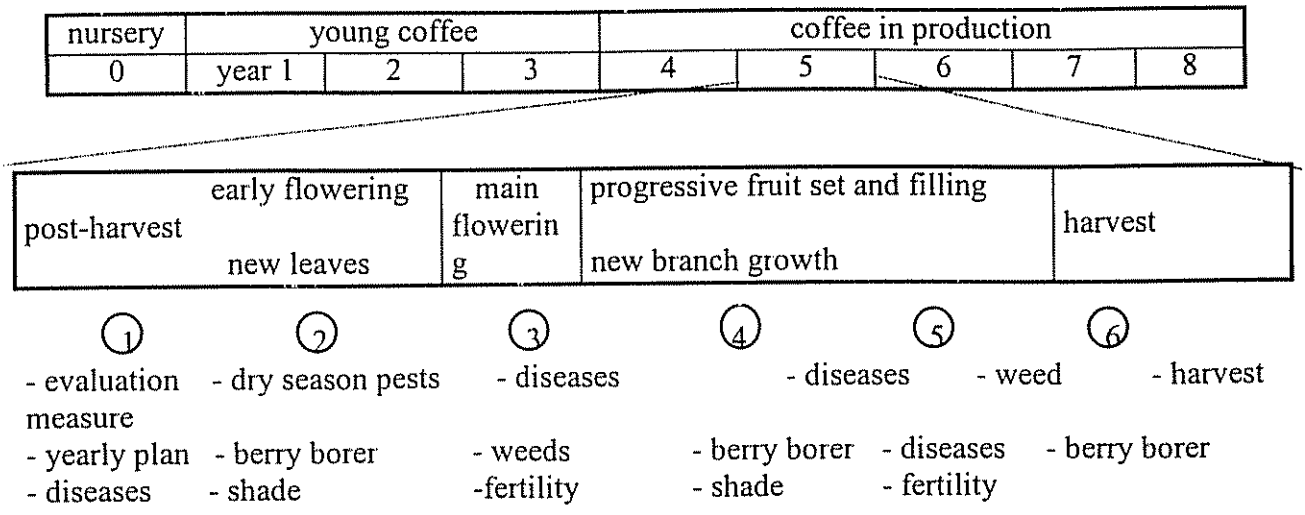

Figure 1: six key moments in the yearly cycle for a coffee field in production can be identified based on the crop stage, seasonal weather, and farmer planning and decision-making. Each moment is characterized by a particular set of themes for observation and analysis.

With dry season pests, farmers begin by walking a field in search of pest problems. They analyze symptoms and contruct the life cycle of the leaf miner and mealy bugs. Using a notebook small groups of farmers working together construct crop phenology and contrast dry season pests in shade and open sun. They discuss the design of a coffee plantation with windbreaks and shade to reduce the risk of dry season pest outbreaks. In later sessions farmers bring pest counts from their own fields and review their progress in improving coffee plantation structure.

For disease management, farmers begin by reviewing disease symptoms presented in a flip chart. They also discuss their experience with factors which contribute to disease problems and the most effective control methods. This leads to an analysis of the periods of the year with the most disease problems and how diseases vary depending on weather, plant nutrition, and shade management. By the end of the discussion farmers are eager to try a simple counting method for tabulating diseased leaves which they practice in a nearby coffee field. They return home with a simple brochure to try the counting method in their own fields. In follow-up sessions, growers review the data from their fields, identify factors which might be leading to lower disease levels in certain fields, and analyze their management options and decisions. They also discuss what happens when they discontinue diseased leaf monitoring which should be done every 2-4 weeks.

Farmers discuss weed problems after the first rains have produced a first flush of weed growth. They begin by gathering three types of weeds from a nearby field, one they consider highly damaging to the coffee, one causing intermediate damage, and one causing little damage. The extension agent promotes a discussion to classify the weeds by growth habit. Grasses, vines, and annual and perennial broadleafs are separated from low growing, shallow rooted ground cover weeds. Farmers compare observations on plant height and rooting depth, survival from one year to the next, ability to sprout after slashing, and seeding potential. Farmers also assess damage and benefits for each weed group, and discuss which weeds and ground covers, including leaf litter, conserve the soil without competing with the coffee. They return to the nearby field to count weeds by type and calculate weed cover. The extensionist uses a set of cards with different weed types to analyze with the group the effect of slashing, mulches, selective herbicides, and shade on each weed

group, and devises a plan with the group to control damaging weeds and promote ground cover weeds for the test plot.

Evaluations conducted with participating farmers in 1997 and 1998 documented different dimensions of training impact. In the San Ramon cooperative, after two years of work, 4 of the original group of 6 farmers no longer mentioned berry borer as a problem pest. They were concerned about other more difficult pests like *Colletotrichum* (CATIE 1998a). Participating farmers were more likely to communicate their results with other farmers, to continue to experiment once the training was completed, and to reinvest profits in their farms than non-participating farmers (Wiegel & Guharay 1998). In a two-day meeting among 34 participating farmers from different coffee zones, farmers proposed key skills they needed for improved pest management-pest diagnosis, identification of factors favoring and disfavoring crop susceptibility and pest increase, how to monitor pests and analyze numbers, experimentation, and communication with other producers (CATIE 1998b). These results suggest that participatory group training and experimentation provide farmers with skills for better pest management decisions and increase their motivation to assist their neighbors. This training approach needs further modifications for farmers who do not read or do elementary arithmetic. Further study also is needed to increase the regularity of farmer attendance in training events and to promote the incorporation of other family members, especially women, in the training (CATIE 1998c).

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