NEED FOR LONG-TERM CROPPING SYSTEMS EXPERIMENTS

M. Zahidul Hoque, John W. Pendleton and S.C. Kim[1]

Background

Crop intensification is a must in Asia, where the scope of horizontal expansion in agricultural land is minimal and a general plateauing of the primary food crop yields has occurred, if the growing millions are to be saved from starvation. Some reports and a school of thought claim decrease in crop yields following crop intensification. Moreover, agricultural economists question relative advantage of intensive cropping patterns as compared to labor utilization in other off-farm enterprises. But the practical questions are: without crop intensifications, how can food supply be increased in Asia? And where will be the estimated 3.7% needed annual increase in rice production come from? In addition, now, there are evidences that there are factors other than continuous cropping that reduce the crop yields. We know of reports where continuous cropping of a single crop species produces increasingly poor yields. Conversely, we also know of other areas and crops that have been grown in successive monocrop systems for many years with no visible yield reductions, if sufficient nutrients were applied. In many other cases, however, production incentives appeared to be critical factors determining crop intensification at a particular place.

Whatever may be the scientists' arguments on intensive cropping patterns, small subsistence level Asian farmers will have to practise intensive multiple cropping systems for their survival. Therefore, those of us who believe this must make plans now to design long term (ten years) experiments to either refute the critics or to identify the factors that might cause yield reductions in intensive cropping, and determine management practices to overcome these.

---

[1]Head, Division of Rice Cropping Systems, Bangladesh Rice Research Institute, Joydebpur, Dacca, Bangladesh; Program Leader, Cropping Systems Program, The International Rice Research Institute, Los Banos, Philippines and Agronomist, Department of Rice Research, Yeongnam Crop Experiment Station, Milyang, Korea, respectively.

Objectives of long-term trials

The specific objectives of the long term trials may be:

- to determine the productivity of selected cropping patterns and crops therein at selected stations over time;
- to determine the effect of growing particular cropping patterns on a long term basis in particular fields on the soil characteristics, and weeds and pest situations;
- to identify the physical, biological and management factors responsible for probable yield reductions in crops grown in the cropping patterns on a long term basis;
- to establish relationships between cropping pattern performance and environmental and management factors;
- to develop soil and crop management recommendations for maintaining yield stability of test cropping patterns in relevant geographic areas; and
- to gradually develop a data base for future guidance and research programs.

Considerations for long-term trials

The following criteria may be of direct relevance while planning and implementing long-term cropping systems trials.

1. The trials should be done on well-run experiment stations and not in the farmers' fields.
2. The proposed trials are not meant to design cropping systems methodology but rather for generation of component technologies that might be needed over time.
3. Comprehensive data collections should be planned. Therefore, number of trials should be based on resource availability.
4. Similar environments might be chosen in different countries and the same crop rotation compared. Conversely a country may be responsible for a specific environment by virtue of having an experiment station located on a desired soil and climate region.

5. Type and extent of data analysis should be well thought of before implementing the trials and accordingly analytical facilities arranged.

6. The cropping systems inter-disciplinary approach should be taken in the planning, implementation and interpretation of the results from the experiments. Particular attention would be paid to the economic consequences along with yield trends and soil physical or chemical changes.

Type of experiments

A common set of basic cropping patterns or crop rotations may be developed first. Each country or program can use the local level of recommended cultivars and management practices. During the early years questions that might not affect long term effects such as varieties or planting patterns might be included in the trials and thus help justify the experiments.

Experimental designs

Standard experimental designs as used in station research may be used. Designs should be uniform across the test sites. At the beginning, only a few treatments should be included thereby making provision for large plot areas per treatment. Replications might be few in number and across sites rather than within sites.

Data collection

The test sites should be adequately described and detail data collection on weather, soils, crop management and crop performance should be made. The following item should be included.

General

- physical characteristics of test site
- toposequence
- water management system

Weather data

- daily rainfall
- daily minimum and maximum temperature
- daily relative humidity
- daily pan evaporation
- daily solar radiation
- daily wind speed
- other unusual weather happenings such as typhoons, hailstorm, etc.

Soils data

- physical properties
- relevant chemical properties
- relevant biological properties

Crops data

- dates of field operations
- dates of seeding/transplanting, harvesting
- growth stages
- yield and yield components
- other agronomic data
- nutrient uptake by crops at flowering and maturity stages

Suggested course of action

1. Appoint a sub-committee in the working group to coordinate the long-term trial planning and implementation.

2. Ascertain by country if long-term trials are already in existence. If there are any, compile the results and interpret yield trends and questions that have arisen.

3. If needed, design add[illegible]nal trials cooperatively for the major rice growing a[illegible]d agro-climatic zones of Asia. In order to accomplish [illegible]:

   a. identify rice growing environments, where cropping systems can be intensified;

   b. agree on the cropping systems, i.e. common patterns vs. improved patterns to be compared;

   c. decide on treatments to be imposed within the cropping systems;

   d. develop implementation plans and necessary data formats.

The sub-committee may have special meetings at relevant places and time to work out the details and follow-up the program.

ASIAN CROPPING SYSTEMS NETWORK

YEARLY SUMMARY OF CROPPING PATTERN TESTING RESULTS

During the Ninth Cropping Systems Working Group held at IRRI the Asian member countries of the Cropping Systems Network agreed to use a new set of summary forms to report the results of cropping pattern testing. The new forms would facilitate an overview of the results in each country and would allow cross comparison of results and methodolo gies among the different countries.

The results of cropping pattern testings were presented by some countries in the new forms in the tenth working group held in South Korea in September 1980. A committee was appointed for analyzing the information presented by the different countries.

From the study of the data presented by Bangladesh, Indonesia, Thailand, Nepal and Sri Lanka it is considered necessary to introduce some modifications to the forms in order to further facilitate the compilation of data and to make possible valid cross comparison of results among the different sites.

There is a general agreement for the yearly cropping pattern summary report to include:

1 - A weather summary

2 - A land type description (one or more for each site)

3 - A cropping pattern management summary

4 - An individual cropping pattern performance summary

5 - A summary of cropping pattern performance of all patterns tested in a land type.

It is proposed that each country summarize all the above information using the attached three forms which would replace the old summary tables.

The Form 1, is for the Weather Summary. This summary will allow to determine the total rainfall in the crop year as well as the amount of rainfall received by each crop in the cropping pattern during its growing season. The first week in the record is Jan. 1-7 and the last Dec. 24-31. With the information of planting and harvesting dates the amount of rainfall received by each crop will be determined. Since a crop year generally falls in two different calendar years, indicate the week when the crop year starts by underlining that week in the records of the rainfall. In addition to the weekly rainfall, monthly averages for maximum and minimum temperature, solar radiation and pan evaporation are requested also in Form 1.