Adapting the Cropcheck extension model to rice production systems in Lao PDR

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Introduction

Cropcheck developed following the identification of limitations to the Transfer of Technology (TOT) extension model which occurred through the 1970's and into the early 1980's (Lacy 2011). Irrigated wheat yields stagnated with high variability from year to year and no understanding as to why this occurred. This was despite several communication methods (farm visits, demonstrations, plot trials, field days, mass media communication and crop competitions) being used to pass on latest research findings and farming techniques. Importantly, the TOT model did not allow farmers to formulate their own questions, explore, learn and understand the new technology in terms of their own world view (Webber and Ison 1995). Cropcheck evolved for irrigated wheat using a participatory approach where famers were collaborators and team players in the process. The model process is a planning, action and review cycle with extension practitioners, farmers and researchers learning from their participation in growing each crop (Lacy 2011).

Agriculture is important in Lao PDR where it accounts for approximately 50% of the Gross National Product (NAFES 2005). However, the agriculture sector is changing with more farmers transitioning from subsistence farming, where they produce food for consumption by their family, to commercial farming, where they produce commodities for market (NAFES 2006). A summary of the development of extension in Lao PDR (NAFES 2005) highlighted that for many years (1960's - 1990's) most extension was based around TOT to improve production. However, in 1996 the Pilot Extension Project started where there appears to be a change in extension methodology. There is now recognition that farmers need to develop the capacity to analyse their own situations and that new technologies should be introduced on a trial basis, for farmers to evaluate themselves. Subsequent to this project there were many others that further recognised that not all technologies were appropriate for local conditions; prioritisation of project activities did not always meet farmers' needs; and there was lack of ownership and poor motivation among Provincial and District staff (NAFES 2005) and farmers.

NSW Department of Primary Industries (NSW DPI) extension practitioners were invited to participate in an ACIAR funded project that was introducing a new method of sowing rice into the irrigated lowland rice production system in the central province of Savannakhet. Cropcheck was considered appropriate because it had the ability to develop information packages, utilising management factors developed from the direct involvement with farmers. The planning, action and review cycle utilised within Cropcheck with local extension staff, farmers and researchers learning from their participation in growing each crop also overcomes many of the issues highlighted by Millar and Connell (2010) and Stelling and Millar (2010) that can restrict adoption of new technologies or long-term change.

Materials and methods

Cropcheck benchmarks the practices of high yielding crops and allows comparison with lower yielding crops, where the target can be in terms of grain yield or in maximising production per unit of resource input, i.e. resource use efficiency. One of the first steps and the ability to do this requires crop records and measurements. Hence much of this project has been engaged in surveying crops and developing a useful crop record that is easily understood by the farmers.

Survey development

In August of 2008 a meeting was held at Thassano Rice Research and Seed Multiplication Centre. The manager of the centre invited; local staff, village and farm leaders and heads of existing organisations such as water user groups from a number of villages. The purpose of the meeting was to discuss the Cropcheck methodology and seek their involvement with the project and the initial selection of farmers to be surveyed.

Following the meeting at Thassano, and prior to the 2008/09 dry season, villages were selected in the districts of Champone, Songkhon and Xaybuli where direct seeding rice was being used or had been introduced by a previous project. The villages were; Dong khan khou and Khor in Champone district; Lahanum in Songkhon district; and Tonhen and Beungxe in Xaybuli district.

The survey used in the 2008/09 dry season was very comprehensive as a means of collecting as much information as possible to indentify all management factors influencing rice production. The information was collected by project staff during two visits, one early in the season and the other corresponding with harvest to assist with collection of grain yield information from the selected fields. In this first year in-field crop information was collected by project staff using the rice rings that were developed and used in Australia for the collection of Cropcheck field measurements. During this process there was often much interest in what the project staff were doing in the fields.

To streamline the survey process for the 2009/10 dry season, farmers were asked at discussion group meetings to identify what they thought were the key management factors influencing rice production. This removed the need to record management factors that had no effect on grain yield variation and allowed the survey to be reduced in size for the 2009/10 dry season. This meant less time was spent surveying farmers and allowed farmers to be involved with the plant counts and weed assessment that was carried out approximately 30 days after sowing. A change back to transplanting occurred in the 2009/10 dry season and as a result questions were added to the survey form in the 2010/11 dry season to provide management information about the transplanted area, including labour/time estimates, and to seek clarification as to why the change had occurred.

Initially the survey and survey results required translation for input into the database, generation of reports and to make changes. However a Lao collaborator was resourced to minimise the requirement of translation which significantly reduced the time taken to interrogate the information and generate reports. It has also reduced the chance of erroneous information entering the database.

Farmer selection

In the 2008/09 dry season 17 farmers from each district, with a range of rice grain yields, were selected by local District Agriculture and Forestry Office (DAFO) staff. This was important because of their local knowledge and to provide them with some ownership of the process. Within each farm three fields were selected representing positions high, middle and low in the farms topography. This provided a total 51 fields in each of the Cropcheck locations which, in Lahanum, represented approximately 16% of the rice fields in the area.

During the 2009/10 dry season farmers were again selected by the local DAFO staff, who were a mix of previously surveyed farmers and other farmers. However, the number of fields per farmer was reduced to two. The number of farms per district was increased to 25 as a means of increasing the variation in crop management and grain yield in the survey information collected.

In the 2010/11 dry season the number of fields was maintained at 25 with two fields per farmer. However during this season fields were targeted for a comparison of the traditional transplanting method of rice sowing and direct seeding using either broadcasting or drum seeders. This change was made because during the 2009/10 dry season there was a significant shift back from direct seeding to transplanting and the reason for this needed to be investigated.

Farmer and DAFO staff consultation

One of the key elements of Cropcheck is ensuring that all collaborators have a sense of ownership to provide them with continued enthusiasm, and importantly, because the farmers have been involved with the collection of local data the information has higher credibility than information produced from other areas. Whenever visits were made throughout the seasons DAFO staff, village leaders and farm leaders were always invited and participated whenever they could.

At the completion of each season results from the surveys were reported back to the growers at discussion groups. This has not yet been done for the 2010/11 dry season. The main findings were presented and questions asked of the farmers and DAFO staff to determine whether they agreed or disagreed with the information. This provided a focus of discussion within the groups and importantly allowed a measurement of the success of the survey in terms of the information that was being collected.

The discussion groups were held in either the village leader's homes or in local meeting huts. The survey information was presented in poster format with most farmers coming prepared with notebooks and taking notes during the presentation of information and discussions (Plate 1). Often the meetings were attended by more farmers than had participated in the survey collection.

Plate 1: Discussion group in Lahanum village with farmers taking notes of the information presented

Photo: John Smith

Results

Over the three years of farmer surveys a total of 201 farmers and 453 fields across the three districts were used for the establishment of a Cropcheck database for dry season irrigated rice production in the central Savannakhet province of Lao PDR.

Key check identification

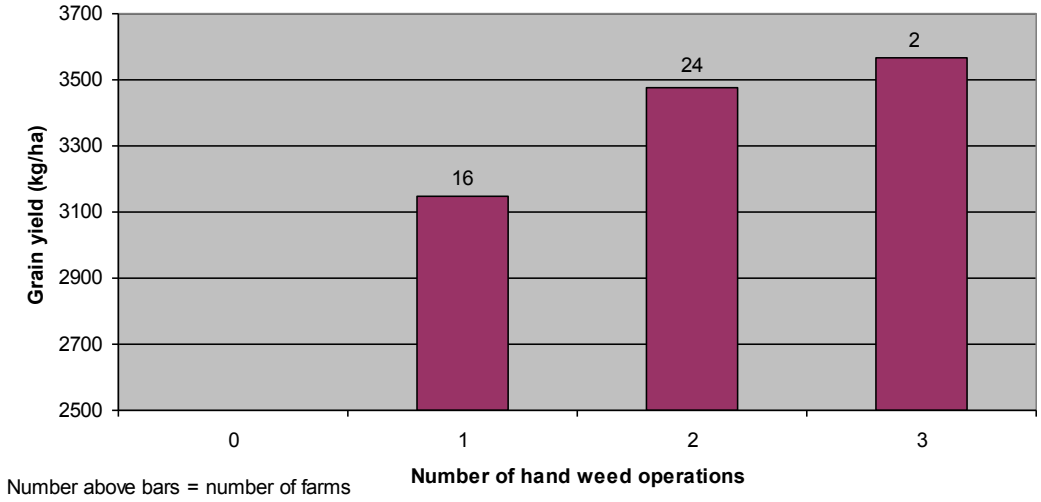
The survey information collected for the development of the Cropcheck database led to unexpected results in terms of the identification of crop management factors that contributed to grain yield variability. Keeping crops weed free up to 100 days after sowing showed grain yield advantages; with the presence of weeds at this stage reducing grain yield from about 5.5t/ha to 1.5 t/ha in Champone and Xaybuli districts. Similarly the number of weed control operations also influenced grain yield. In Xaybuli a possible key check is to maintain a weed free field up to 100 days after sowing using two weed control operations (Figure 1), although the economics of the labour cost compared with the increase in yield would also need to be compared.

However, factors such as plant density and fertilizer management that play an important role in Australia did not influence grain yield in the surveyed fields. This highlights one of the limitations of the survey and is discussed in the issues that have limited the development of Cropcheck in Lao PDR section.

Beneficial outcomes for farmers

Variability of grin yields within a farm was identified between the fields surveyed. Fields lower in the farm topography yielded higher than fields with a high position in the farm. This occurred regardless of farm position within the toposequence of the area and was a new finding for researchers. Following discussions with the farmers it was discovered only the lower fields maintained flooded water conditions between irrigation water applications. Irrigation is restricted, due to pumping infrastructure, to water delivery every 7 – 10 days. There is an opportunity for farmers to vary inputs or change the management of inputs between the areas of different water management, although the capacity of farmers to be able to do this needs also to be considered. This result also highlighted that Cropcheck needed to be adapted to measure resource use efficiency, as it does with dryland cropping in Australia, instead of maximising rice grain production and profitability as it does for the Australian rice industry.

Figure 1: Influence of the number of hand weeding operations on grain yield in Xaybuli district over two seasons.



Number above bars = number of farms

During farmer discussions it was apparent many thought change was associated with increased costs, which was often a barrier. An example of where this was not the case was observed during field visits. Farmers had adopted the broadcast method of direct seeding but had not been shown, or properly understood, how to sow seed evenly in large areas. This resulted in areas of very high and very low plant populations, which restricted plant development (Plate 2). Further training in uniform sowing could improve crop production at no extra cost.

Plate 2: Seeding rate variability within fields with areas of very high and very low plant populations influencing grain yield

Photo: John Smith

There have been many different fertilizer management practices for either application rate or timing of the application identified from the surveys. For example, within one of the districts as many as 21 different practices for the 25 farmers surveyed were identified in a particular year. Best practice fertilizer management would lead to fewer variable practices. This aparent lack of understanding of fertilizer management has led to farmer training being conducted in 2011 as well as factorial experiments during the 2010/11 dry season where the benefit of N application up to 120 kg nitrogen ha^{-1} was demonstrated.

There has been limited information collected in the surveys on the influence of pests and disease on production because farmers have not been able to clearly identify if plant symptoms are the result of pests or disease. Thus another area of farmer training has been identified by the process.

Issues that have limited the development of Cropcheck in Lao PDR

The duration of the project restricted the degree of development of Cropcheck. Initially the project relied on members who were either remote to Lao PDR or were doing this in addition to other main areas of work, which resulted in some outputs not being completed. As the database developed it became apparent that a champion for Cropcheck development was required, however the social structure within Lao PDR limits who can be utilized in this role. Cropcheck is now being investigated for adaptation to rice in the wet season, in a separate project, and due to the experience in this first project a suitable person was selected by Lao project management to be the Lao champion for Cropcheck.

Cropcheck identifies variability in crop/pasture performance but in Lao PDR the development has been restricted because of the degree of variability in crop management that has been identified. Two main areas of crop variability have been in seeding rate and fertilizer management. The seed used for sowing is sourced from the previous crop and at sowing a subjective assessment of germination is made and the seeding rate is adjusted at that time. The surveys identified seeding rates up to four times that of the recommended rate but the project was not able to conduct germination tests to determine if these high rates were required. The amount of variability in fertilizer management, and relative to this variability the sample size used for the surveys has not been able to identify best fertilizer management practices. There is also the added issue of the farm operations being done by hand rather than machine which adds another level of variability.

The language barrier and requirement for translation has caused some issues. These were related to the time that it took for the translation to occur and because not all words translate. In some cases the intent of the question may have been lost or changed. The inclusion of a Lao collaborator with good English skills has reduced the requirement for translation.

Discussion

The development of Cropcheck in Australia has seen the progression of industries, such as the rice industry, for total production and also for water use efficiency. Cropcheck has also provided a dramatic improvement in farmer understanding of the whole rice farming system rather than individual components and operations within the system. The conduit that Cropcheck offers between farmers, extension staff, government agencies and researchers plays an important role even for basic farming practices such as sowing method. Broadcast sowing (Plate 2) offers labour savings compared with transplanting and research has developed recommended sowing rates for good quality seed. However, there is also a need for additional training in the broadcast sowing technique to achieve an even plant stand. Practical field issues such as this can be identified during the discussion group activities and field visits that occur during the season as part of the Cropcheck methodology.

Cost, limited resources for DAFO staff, infrastructure restrictions and lack of mobility for some DAFO staff are all limitations to the success of the system. Stelling and Millar (2010) found with livestock industries that capacity building techniques such as Farmer Field Schools offer a high benefit to cost ratio because they provide a learning opportunity and interaction for both farmers and local staff. The discussion groups used in the Cropcheck methodology offer a similar capacity building opportunity. The other limitations are more difficult to overcome although may only be limitations for a finite period as other communications develop. For example, Lao PDR has an extensive mobile phone system that could be utilised for crop management updates as an alternate communication option besides the publication of results.

Conclusion

The irrigated rice farming system in Lao PDR has much more variability in crop management than in Australia. Coupled with the restriction of time for the project this has limited the identification of key checks that maximise resource use efficiency. However the process of farm surveys, crop inspections during the season and farmer discussion groups have highlighted areas where crop management can be improved through additional training. Importantly some may lead to improvements in farm productivity with no extra cost to the farmer.

The potential benefits to the farming system that Cropcheck has highlighted are an advantage. However, limitations outside of projects of; resources, labour, training and extension capacity may restrict the development of the system into the future. Past Cropcheck training experience shows project duration of a minimum of 10 years is needed to achieve technology and resource change adoption.

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