The adoption of ICM technologies by poor farmers in Nepal

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Introduction

Rural poverty remains pervasive throughout Nepal, the poorest country in South Asia and a predominantly agrarian nation, with 60% of its GNP derived from agriculture. The principal foods are cereals (rice, maize and wheat) with grain legumes grown as secondary crops during the winter, mostly in paddy fields using residual moisture for plant establishment. As the staple crop, rice is grown in 1.45 million hectares across the country but 400,000 ha remain fallow in winter (Subba Rao et al. 2001). The exploitation of this uncultivated land offers one route to resolving problems of food security in Nepal. Chickpea (*Cicer arietinum* L.), the 3rd most important pulse in Nepal after lentils (*Lens esculenta*) and pigeonpea (*Cajanus cajan*) provides a high yielding and high value crop option for poor farmers. Like all pulses, chickpea is a very important source of protein for poor rural families and equally so for the urban poor. It is also valuable because it is a highly versatile grain and is used for making biscuits, breads and sweets as well as a soup vegetable. It provides an excellent crop with which to tackle food security and alleviating malnutrition, and as a winter crop, it lends a strong focus on the agricultural role of women.

However, yields of chickpea have decreased in recent years primarily due to disease and insect pest problems and the reluctance of farmers to invest time and money in a crop that increasingly fails. This has resulted in a decline in grain legume consumption to about 25% of the level recommended by FAO ie, less than 10 kg/capita/annum (Pandey et al. 2000). Owing to severe crop failures, especially in the 1997/98 season, upto 90% of chickpea consumed in Nepal is now imported according to Johansen (2001). This frequent crop insecurity associated with the production of chickpea over the past twenty years has seen a decline in area sown under chickpea drop from more than 50,000 ha in 1980 to less than 10,000 ha in 2003 according to reports at this meeting. A decline in the production of leguminous crops could have a negative impact on the sustainability of the cereal-based systems because legumes enhance soil fertility through nitrogen fixation and as organic matter.

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While yields using traditional approaches are low (< 0.8 t/ha), the scope for increasing chickpea is high through increasing efficiency, exploiting the large area of winter rice fallows and the simple fact that there is always demand in a country that has a 90% deficit of the crop. How long might it be before Nepal begins importing its chickpea from Australia or Canada?

Major project outputs – Phase 1

The overall aim of this project was to promote the adoption of an Integrated Crop Management (ICM) strategy for increased chickpea production and the outcomes of the project have been reported (Pande et al. 2003a, b & c; Stevenson 2004). Within the first phase, we aimed to achieve several specific goals, which are summarized below (Pande et al. 2003a & b).

1. Survey current farmer practices for chickpea production using participatory rural appraisal (PRA) – what are the problems?

The outcome of this phase are detailed by Pande et al. (2003a). The area of production was declining and farmers were achieving low yields. Farmers were also reportedly not optimizing production or managing constraints. One direct outcome of this was a severe outbreak of BGM in 1997/98, which severely affected farmer confidence in the crop. More specifically, farmers reported a lack of quality seed and of suitable progeny with ineffective or adulterated agrochemicals and a poor knowledge of how to use them. Seed losses in storage were also reported but by far the most important constraints according to farmers are the diseases Fusarium Wilt and BGM along with the pod borer. However, it was also clear that the scope for increasing production was considerable through increasing efficiency and exploiting the large area of winter rice fallows.

2. Develop and validate a new ICM package that was appropriate, effective and affordable.

The second output of the first phase was to develop the technology and present it in a way that was usable by farmers. The ICM package consisted of the following components:

1. Improved cultivars, Avarodhi or Tara, which are both resistant to Fusarium wilt, tolerant to BGM and high yielding. Importantly, these were selected by farmers themselves as preferred varieties in participatory selection trials.
2. Fungicidal treatment of seed (thirum + Bavistin (1:1 ratio) @ 2 g/kg seed).

3. Seed priming to increase germination and overall vigor.
4. The application of Rhizobium inoculum @ 3 g/kg seed (where not previously applied).
5. Addition of diammonium phosphate (DAP) @100 kg/ha.
6. Prophylactic BGM control (Bavistin @ 1g/liter of water; 17 liter of water/katha).
7. Pod borer control with Thiodan @ 3 ml/liter of water (17 liter of water/katha).
8. Boron application in areas shown to be boron deficient (restricted to some farms in the central region).
9. Maintenance of an open canopy to reduce microclimatic humidity and thus reduce BGM by avoiding excessive fertilizer or irrigation.
10. Encouraging sun-drying seed prior to storage to reduce insect infestation and subsequent treatment with naphthalene, Azadirachtin, oil or chilli powder to maintain seeds insect free. Also keeping seed in sealed containers.

It is worth noting that 2 to 4 operations can be achieved in one single treatment.

3. Produce and disseminate promotional tools on ICM.

The ICM package was promoted through farmer schools, NARC extension services and NGO links established under the previous ICRISAT led crop diversification project, funded by the Asian Development Bank (ADB). A central facet of the project was to use the farmer participatory techniques previously developed by ICRISAT/NARS under previous grain legume projects so that farmers themselves should conduct all on-farm trials. The performance of the package based upon grain yields was monitored but simple tools were needed to provide farmers with a guide to ICM along with farmer schools.

The NARC/NRI/ICRISAT team developed promotion tools for the new chickpea ICM system. As well as posters and materials for showing farmers at field schools, the team produced information cards in Nepalese detailing all stages of chickpea growth, when they are affected by the principal target constraints of the project and how best to manage them (Plates 1 and 2). During the 2000-2001 season, promotion tools for new integrated technologies were distributed. These sheets were produced and used during the main promotion phases in years 2 and 3. They were disseminated to at least 2000 farmers in the target areas in year 3. They have now been updated.

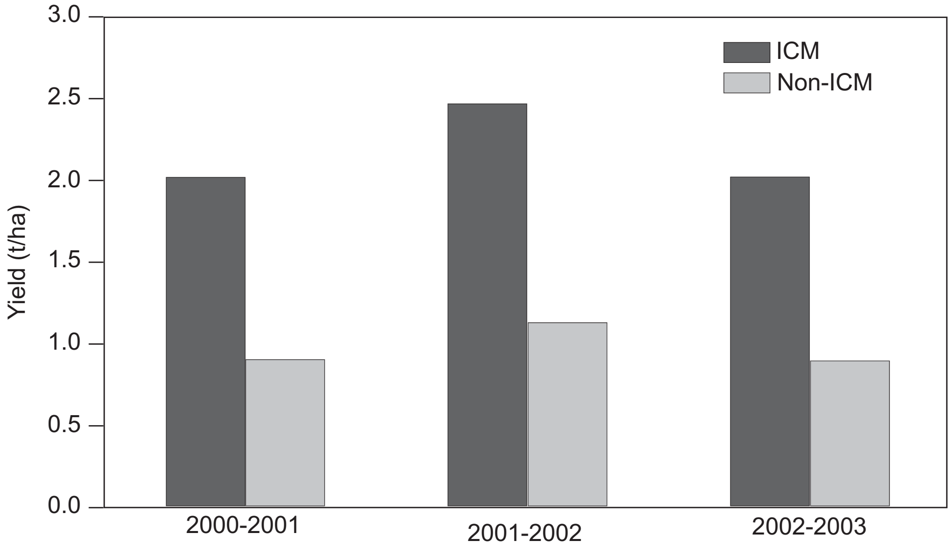

Fig. 1. Yield of chickpea with and without ICM, 2000-2003.

4. Rebuild confidence in farmers.

On-farm grain yields achieved by farmers throughout the project area have shown farmers that it is possible to grow chickpea profitably. Not only have yields doubled (Fig. 1) but because of the relatively low additional investment for the ICM technology above that already required for the traditional production, the actual unit cost per kg is almost halved when using the ICM package developed on this project (Table 1).

Table 1. The economics of chickpea production (NRs/ha) with and without ICM.

	Without ICM	With ICM	Change (%)
Total cost	14962	16454	9.97
Gross income	24120	35440	46.93
Net income	9158	18986	107
Unit cost of production (NRs/kg)	17.53	9.26	47.18

Major project outputs – Phase 2

Phase 2 of the project aimed to promote the knowledge widely, develop up-scaling strategies, evaluate impact and identify exit strategies.

1. Promote project technologies widely and increase numbers of farmers growing chickpea in the Terai and increase area under chickpea production.

In order to start the promotion process, farmer field schools were conducted with all farmers prior to the chickpea-growing seasons in years 2 and 3 to inform participants and distribute promotional tools and technologies. In the 2001-2002 cropping season, the validated package from output 3 was promoted to target farmers. In the first season, the aim was to involve an initial target group of 500 representative farmers from the main target areas for validation but in subsequent years, the aim was to scale up promotion of the package.

Trials expanded dramatically in subsequent years. In 2001/2002, 1100 similar trials were set up with farmers, in new districts as well. In 2002/2003, more than 2000 farmers received the IPM package ingredients to try. Further, local scouts and farm leaders indicated that many elements of the IPM practice had been adopted by an estimated additional 5000 farmers, who had assimilated the knowledge by various local processes of communication. Farmer schools consisted of small groups of no more than 50 farmers from the same village who knew each other and were able to discuss IPM in the same language and with relevance to particular farming approaches peculiar to their village or district. The dissemination to the Nepali farming community was carried out directly through project promotion activities and through established NARC network and activities such as farmer schools. In addition, local media were also targeted for press releases and articles. To inform the scientific community in South Asia, articles and information bulletins have been produced and published.

2. Ensure sustainability of outputs and identify exit strategies.

It was central to the project plan to develop mechanisms that ensured sustainable outputs. It was important that ICM technologies still be used after the lifetime of the project. The first indication of success was when farmers told us in various surveys that they would continue with the ICM. Survey information indicates that this is the case with a majority of farmers involved. However, additional indicators of longevity were predicted from the involvement of a seed seller who set up interactions with community based organizations and commercialized the broader distribution of both the seed variety and the technologies by copying our information sheets. We also provided some seed varieties and technological advice to a parallel project working on legume production in rainfed rabi cropping systems via NGO, FORWARD. In some of our target farmers groups, we met with resounding success notably in Lalbandi village, Sarlahi district. In October 2001, we provided approximately 400 farmers with 1.2 kg each, which was enough to produce 1 katha (0.033 ha) each. The total area sown in this year was 13 ha. However in October 2003, the area in Lalbandi sown to chickpea was more than 120 ha indicating that farmers were adopting the technology, were securing their own seed for up-scaling and were expanding their winter cropping remit.

3. Determine impact of activities.

We conducted surveys throughout the project and the results of these surveys are published by Pande et al. (2003 a, b & c) and are presented by Bourai et al. (2005). The studies comprised a 7-day survey of group discussions with 300 farmers and the findings revealed that the impact on livelihoods was substantial with a majority of farmers describing improvements in all aspects of domestic life, although the extent of these impacts depended on the size of holding.

Overall domestic expenditure in the households increased by 45% over the course of the project reflecting farmers' increase in wealth. This extra income allowed the majority of households to increase expenditure on children's education, and purchase of food and medicine. One dramatic change was the number of farmers moving from mud houses to brick houses or even building them from scratch (5-10%). Upto 22% of farmers reported paying off debts. There was also a direct impact on employment with number of days of employment for ICM farmers increasing by 62% compared to non-ICM farmers.

Conclusions

The present study successfully promoted the adoption of crop protection technologies for improving the productivity and reliability of chickpea in smallholder farms in Nepal.

The following factors were understood to influence uptake and adoption:

- The institutional set-up for research and dissemination.
- Available crop protection strategies or technologies.
- Dissemination methods employed.
- Farmer circumstances.

It is evident that the institutional set-up for research and dissemination does exist. In the majority of cases, inadequate resources appear to be a constraint for both research and extension. There is therefore, a need to form partnerships in order to make the technology generation and dissemination process more responsive to farmers' needs. The public, private and NGO sectors, working as service providers together with the farmers, ought to be involved in the research and dissemination process. This would appear to be a feasible arrangement given the dwindling resources for agricultural research and extension.

It is also evident from the present study that the key attribute of any given crop protection technology is demonstrable efficacy and availability of technologies. For that reason, the majority of chickpea producers in Nepal should continue to employ chemical control methods although HNPV is an effective alternative and is described by D Grzywacz in this volume but is not presently generally available. Given the quality associated with chemical control strategy and increasing reports of insecticide resistance, there is an even greater need for establishing HNPV as a widely available alternative.

The present study revealed an array of pathways for disseminating crop protection outputs. NARC appears to have adequate and functional extension systems but the Department of Agriculture (DoA) is the principal extension service in country, and so it is essential that DoA shows commitment to up-scaling the outputs of this project to ensure broad uptake and ultimately poverty alleviation. In terms of strategies for scaling-up, the approach to most likely to succeed would be via the distribution of mini-kits.

The cost of ICM inputs for chickpea/katha are:

Seed (1.5 kg)	NRs 45
Seed treatment components including Rhizobium	NRs 10
Fertilizer (DAP)	NRs 40
Fungicide for BGM	NRs 25
Insecticide for pod borer	NRs 35
Plastic bag (for dry storage of seed for next year)	NRs 10
Information leaflet	NRs 15
Total	NRs 180

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