Country-wide extension of Integrated Crop Management of chickpea in Nepal: Lessons learned and future approaches

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Abstract

This paper discusses lessons that have been learned both from discussions at the present meeting and those distilled from experiences of project partners during the collaborative activities of NARC, ICRISAT and NRI under the Crop Protection Programme's (DFID) project to rehabilitate chickpea in Nepal (DFID R7885). Chickpea is a crop that can compete with alternatives; it is highly profitable when grown with appropriate technology and improves livelihoods for poor farmers. Markets per se are not a limiting step for the nationwide expansion of improved chickpea production in Nepal (most chickpea consumed in Nepal is still imported), but aspects of marketing are, and need addressing to ensure trouble free expansion of chickpea production. Aspects of infrastructure also need addressing, especially the connectivity between research and extension organizations in Nepal, to enable joined-up extension services and technology support. Seed storage has too low a priority for both farmers and extension services and needs greater focus. Pesticide quality and insecticide resistance need monitoring and infrastructure and policy/legislation to support biological alternatives such as NPV needs attention. Farmers' past experiences with particular management tools (eg, familiarity with insecticides from vegetable production) often coincided with success, and finally skills of diagnosis and timing for applications of technology needs particular attention across all farmers. Because chickpea is self-fertilizing, farmers can produce and maintain their own seed stock negating the long-term role of seed production enterprises in up-scaling. The project also encouraged low cost inputs, which are less financially rewarding for Small and Medium Entrepreneurs (SMEs). There is, however, always a need for technology inputs and seed provision for new farmers so there is still a role for the private sector.

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Self-help groups increasingly need to take on the role of seed producers. Agriculture holds a position of low priority in popular media such as newspapers and television, so alternatives need to be exploited to ensure widespread knowledge dissemination.

Introduction

This meeting of international researchers, HMGN institutions, NGOs and farmers has been a forum for some forthright and constructive presentations and discussions, and has provided valuable information about up-scaling successful research and development strategies for alleviating poverty through agricultural development in Nepal. Much of the information surrounding the production constraints for chickpea have been highlighted along with the problems associated with their management. The constraints can be classified as research, extension and farmer constraints, and action will need to be taken at each of those levels before an efficient, effective and sustainable technology is in place at a country-wide scale. The constraints include:

- Marketing (market linkages, market studies, market information)
- Changing farmers' perceptions of chickpea as an income generating crop
- Changing government perceptions so that the subsidy system can equally favor pulses
- Seed multiplication and storage (formal and informal)
- Further development of pest management technologies
- Action to improve the quality of available pesticides
- Credit (convincing credit organizations that chickpea is a creditworthy enterprise, and educating them on appropriate "chickpea credit packages")
- Developing chickpea as part of a farming system rather than as a single commodity
- Information materials production and information dissemination (by a range of media/methods)
- Advocacy and promotion (success stories; how to best utilize the "champions" you have already got)
- How to fit the promotion of this technology within the rigid bounds of NARC and DoA – or how to complement/supplement their capacities by using NGOs, farmer organizations, private enterprise etc.

We have also heard similar stories about other crops from similar systems and much about affordable and practical ways to manage constraints. Farmers themselves have provided valuable personal insight into the successes that can be achieved by following the associated technology guidelines promoted by the ICM of chickpea in Nepal project – especially where farmers use the information sheets (Appendix 1). In this paper, we highlight lessons learned from these experiences that are important considerations for up-scaling.

Economics

Encouraging farmers to go back to producing chickpea can be complicated by their perception that chickpea requires a high investment and that there is a lack of systematic marketing. However, the ICM of chickpea in Nepal project has shown that with a small additional investment (see Stevenson et al. in these proceedings) the rewards are greatly increased to a point where production costs are effectively halved. What's more, farmers themselves reported at this meeting that marketing the crop is not a problem. Despite farmers' perceptions that markets were not a limiting step and that there was always a demand in the market, aspects of up-scaling were identified as areas needing attention suggesting that these had been neglected – such as market linkages, market studies, market information. Clearly country-wide up-scaling will require some thought with respect to markets and infrastructure. Overall, it was accepted that there is a considerable shortfall of chickpea in Nepal and the deficit of production is approaching 90% according to some observers here. Thus in the grand scheme – as perceived by farmers – there will always be a market but facilitating distribution beyond villages where chickpea is grown and storage facilities will be strategic hurdles that will need to be borne in mind as the scaling-up of chickpea production takes off.

The question of whether chickpea is a commercially viable crop was also raised but this is clear from the outcome of livelihood studies undertaken as part of the present project and are detailed in Bourai et al. (2005) in this volume. Chickpea is a crop that can compete with alternatives since with considered and careful application of ICM, chickpea out yields alternative legumes and in terms of financial return exceeds wheat. This fits with current policy described by Dr Upadhaya, Member of the National Planning Commission, as re-orienting towards commercial, income-generating crops including non-cereal crops such as pulses. Upadhaya also highlighted the need for better complementarity between NARC and extension systems such as DoA and only then could Nepal really expect to go from the 3500 farmers touched by this project to a respectable proportion of the 2.8 million farming families in Nepal.

Land tenancy and problems associated with hidden subsidies for cereals crops works against them being prioritized by farmers and the balance of subsidies and indeed emphasis in MoAC needs to be changed.

Management of pests and diseases, and alternative approaches

The environmental concerns of controlling pests and diseases on chickpea with chemicals are predictable. However, the application rates promoted are extremely low especially compared with rabi alternatives such as wheat.

Caution needs to be taken with quality though and some NARC backstopping to check regularly the materials being used by farmers could help in this respect. Adulterated pesticides can lead to lower efficacy and build up of pesticide resistance in target organisms. Furthermore, it should be remembered that the efficacy of pesticides in some parts of the country are reportedly worse than in others. Notably, Thiodan, the insecticide promoted by this project was often reported to be ineffective at controlling pod borer in the mid-west. It is likely that this is due to local populations of pod borer arriving from nearby cotton in India that are sprayed up three times a week. Thus, the likelihood of pesticide-resistant populations of pod borer is high. Transgenic approaches to the control of *Helicoverpa* pod borer have been introduced in Bangladesh and may be an alternative route for controlling this intractable insect pest of chickpea in Nepal. However, as with other novel control strategy such as HNPV, the appropriate regulatory structures are not in place in Nepal and need to be implemented. Currently, it is not possible to promote NPV to farmers since it is not sustainable in the absence of a local large-scale production of the virus and no expertise for quality control or technological backstopping. Future plans to move to the use of bio-pesticides would benefit from investment of time and funds into the development of an in-country expertise such as between an NGO like FORWARD and the government scientists from NARC.

BGM has a broad range of hosts and consequently cross infection from other sources was highlighted as an unforeseen pathology – notably from pigeonpea (C*ajanus cajan*) – a crop grown frequently on paddy bunds and in close proximity to chickpea. Marigolds are also grown frequently in rural gardens as an ornamental addition and are culturally important. The flowers are particularly susceptible to BGM and the occurrence of hyphae spores on these flowers would normally be visible before or at the same time as chickpea and certainly be more visible. The use of marigolds as an early warning mechanism for BGM on chickpea has also been highlighted by ICRISAT (S Pande, pers. comm.) and could thus indicate to farmers when to spray Bavistin as promoted under ICM of chickpea in Nepal.

There were some reports that BGM-tolerant varieties were available in India and some hope for a natural control measure for this persistent disease. However, resistance in crops like chickpea is invariably dependent upon the production of small anti-fungal molecules called phytoalexins at the point of infection but only when fungal hyphae are invading roots (Stevenson et al. 1997) or leaves (Stevenson and Haware 1999). The reason it is so difficult developing resistance to BGM is because the disease attacks the flowers, which are not able to produce phytoalexins, so chickpea plants are susceptible to disease even when the leaves and roots are apparently resistant.

It is also worth noting that farmers who had previously used their land for the production of vegetables especially tomatoes – a crop that requires inputs

such as pesticides – were able to adopt the ICM of chickpea very successfully and have been more likely to continue to do so after the lifetime of the project. This has been particularly so in Sarlahi district where fields of rotting tomato have been replaced by fields of chickpea that require far less investment in crop protection inputs. It is likely that previous experience of the value that management of pests and diseases has to yield and crop security is an indicator of likelihood of more successful adoption. Some participants have pointed out that the technology may be too complicated for some farmers. This may well be true where farmers do not have experience of the investment of technologies and effort into rabi crops particularly legumes and are more likely to broadcast onto rice fallows and see what comes up. These farmers may be less likely or able to adopt a strategy such as that promoted under this project.

Seed production, information flow and dissemination

The need to address information flows was highlighted and although was addressed to some extent in the present project, CBO/NGO partnerships and the ultimate integration of DoA extension is absolutely paramount to any successful up-scaling along with improved roles for commercial organizations. Seed sellers, for example, are considered an important route for up-scaling and sustainability. This project itself has highlighted their role in the exit strategy. However, most commercial interest in seed production is associated with crops in which hybrid seed is required. Since chickpea is a self-fertilizing crop, once farmers have a particular variety they can maintain their own seed stock thus negating the long-term potential role of small and medium enterpreneurs. So, in theory, unless the provision of seed is associated with the provision of quality technologies and perhaps even ICM guidance, the role of the commercial sector may be limited. The reality is somewhat different, however. Although many farmers do reserve seed for subsequent seasons, many do not and see most advantage in selling as much as possible as early as possible to secure the cash for a crop as valuable as chickpea. Thus, the role of seed sellers is still important especially with a crop that requires an involved technology – the seed seller can provide the seed along with the correct technologies as well as the technology back stopping.

Alternatively, self-help groups or community based organizations are increasingly taking on responsibility for seed production and one farmer reported a group in which investments reap financial rewards from investments that are highly impressive.

Agriculture has not yet found its due place and space in the media, despite it being a predominant feature of Nepali life. Research needs to develop a media-friendly information system and a farmer-friendly dissemination system. There need to be separate, but integrated information flows for national (policy) and local (farmer) levels of dissemination

Crop diversity

Crop diversification, especially as part of an improvement program for legumes in rainfed rabi cropping is considered by most development policymakers and scientists to be a key element of any national development strategy, in this case for Nepal. The Agricultural Perspective Plan Support Program (APPSP) of the Ministry of Agriculture and Cooperatives in Nepal recognizes the importance of diversity particularly for legumes but also for other vegetables and this led to the successful ADB-supported Crop Diversification Project in Mid- and Far-West Nepal. The current phase of the present project recognizes the limitations of promoting a single crop and this was indicated in the Project Memorandum. However, the ICM package is an involved technology, and so embedding it in the national agricultural strategy may only be possible with highly focused efforts, ie, by promoting it as a single crop development strategy. Otherwise, particular technologies that are crucial only for one crop in a crop diversification strategy, (eg, pod borer control in chickpea) could become low priority as it has little relevance in the other crop alternatives such as lentils or grass pea. This in turn, could lead to heightened effort for chickpea production as part of a chickpea production strategy but without emphasis on crucial but particular aspects to chickpea production leaving farmers with poor returns from chickpea. Ultimately this would lead to the same problem that farmers are facing now – low confidence in their ability to achieve good and profitable yields. High yields from chickpea are almost impossible to achieve without specific management of pod borer and other constraints. When they are managed however, few crops can yield as well as and earn as much as chickpea.

Single commodity approaches were cited as inappropriate also because it is considered important to present a set of options within a systems context. It was frequently suggested that farmers should be able to choose their route out of poverty from a range of options that they believe are more suitable to them. This is particularly so given that some farmers will want to grow different crops for personal or traditional reasons or perhaps because in some regions chickpea is less appropriate owing to climate. However, many farmers at our workshops confessed to not knowing what and to do and sought continual direction from technology experts in their strategy to grow chickpea. Moreover, it should be remembered that this project is promoting a strategy to increase (and more than double) chickpea yields among traditional chickpea growers who used to grow the crop happily, but the success of which requires the application of fairly involved technologies that we have promoted for chickpea ICM. Because they are involved or complex, a concerted effort to embed this practice alone is needed to ensure farmers have a clear, tried and tested experience of all the inputs and subsequent benefits. Once this has been achieved, then its role in a crop diversification approach can be considered.

It is, of course, important to be able to understand why some farmers don't continue to adopt given strategies after the experience of demonstrations and farmer field schools particularly after the lifetime of a project. It is possible that the absence of the technological backstopping and continued direction mentioned above is a problem. In which case, one particularly effective mechanism for transferring information and maintaining a good knowledge base among farmers rather than relying on that supplied by technical field visits by extension workers is through farmer cross visits or through traveling seminars involving farmers. These are also very effective in motivating farmers to consider new technology. Even the farmers at this meeting who are group leaders and largely successful at implementing involved strategies have suggested that this is an important component of sustainability.

India, Bangladesh and beyond

One emphasis of this phase of the project with respect to up-scaling is across borders and the need to help neighboring countries achieve their own development goals through the uptake of technologies developed in this project. This is particularly so for Bangladesh, where legumes are being relegated to marginal lands where they achieve poor returns and, as witnessed in Nepal, productivity is declining as a consequence. Alarmingly, Bangladesh will need 748,000 tonnes of legumes by 2010, and they are far short of that at present. There are 1000s ha of suitable land in the Barind Tract for expansion of chickpea as well as other legumes but as with Nepal there are constraints – but it should be noted that these are not always the same. While *Helicoverpa* pod borer is a severe constraint in both Nepal and Bangladesh, collar rot is reportedly a more serious problem than BGM or wilt. *Helicoverpa* and BGM are both the major biological constraints to chickpea production in India where yields are similar to those achieved in Nepal. Thus transferring technologies from apparently the same agricultural system in one country to another is not necessarily straightforward and detailed studies need to be undertaken before up-scaling elsewhere.

Other valuable lessons from Bangladesh are that greater impact is achieved if extension messages reach all clients at the same time, rather than sequentially.

One of the most important factors in the success of the ICM of chickpea in Nepal project was the willingness of local farm group leaders to take a lead role in adoption. This role needs to be rewarded with incentives and perhaps even direct pay but is worth it since local individuals especially educated farmers or local leaders who are known and respected by farmers likely carry more influence than government representatives. This is also important in ensuring continued adoption after a project has run its course. Also, as we found in Nepal, farmers are encouraged by awards that recognize high achievement: an approach that

might successfully be applied in neighboring countries. Successful up-scaling needs local champions, and needs to engage and win over critics. Awards should be encouraged as an additional strategy to build up incentives. It not only adds a competitive element but is also an indication that the agricultural administration is taking notice of the changes that it is encouraging.

Lessons from other projects

Experiences from the Plant Sciences Research Programme of DFID's project on rainfed rabi cropping in rice fallows of Nepal established that farmers were largely unaware of the ways in which rice fallows could be exploited but that when these were identified to farmers they were keen to plant legumes. Time of sowing is critical to success so as to make best use of receding moisture; this varies across the Terai, with moisture staying longer in the eastern parts and soils drying earlier in the western regions. Chickpea is notable among legumes for its very deep root and adaptation to arid climate but is still highly dependent upon water at germination. This can be largely circumvented by ensuring that farmers employ seed priming as part of their seed treatment strategy if sowing in drier soils, although this should be avoided if soils are already moist. This can be indicated crudely by the presence of wet film around a footprint where water is squeezed out of the soil. Our strategy does suggest farmers use seed priming to enhance germination but this is far from being a blanket solution.

The PSRP project also determined that sowing behind the plough is the best planting method and combining with neighbors to grow larger blocks reduces theft, edge effects and cattle grazing and helps facilitate and economize effective spraying against pests and diseases. This requires good community cohesion. An additional constraint was identified in the apparent molybdenum deficiency but this can be overcome by adding molybdenum to seed priming water.

The rainfed rabi cropping project also determined that participatory varietal selections led to promising varieties in a similar manner to the selection of Avarodhi by farmers on the ICM of chickpea in Nepal CPP project. PVS using mother-baby-daughter trials has also been successful in selection of wheat. Only one "mother" is required at each site but replicated through multi-site trials controlled by researchers. Data can be analyzed so that each location is a replicate, but monitoring is done by farmers. When farmers have selected their favorite variety, then the 'daughter' material of the preferred material is further tested by them.

In rice/wheat production systems, some farmer groups were reportedly producing >100 tonnes of rice seed, and were amalgamating into cooperatives suggesting that up-scaling of seed production technologies was possible.

Mechanisms for scaling-up

The supply of mini-kits was cited as a tried and tested way to encourage seed production and is the principal extension tool for the Department of Agriculture. However, when mini-kits are used by farmers for food production and not seed production, this could result in a shortfall of certified seed if a variety being distributed is in short supply. This would certainly be the case with Avarodhi, the variety preferred by farmers during the ICM of chickpea in Nepal project. However, the idea of using mini-kits provides an opportunity for farmers to experience the potential benefits of improved yields on a small scale and this should be the basis for self-financed uptake and their provision should be accompanied by the *caveat* that farmers must retain some of this 'gift' if they wish to continue production. This has worked very well with farmers in the Lalbandi where enough seed was provided for about 13 ha in 2001 and in 2003 farmers had sown 120 ha. New initiatives under the Agricultural Perspective Plan Support Programme through District Agricultural Development funds such as the District Extension Fund and the Local Initiative Fund provide opportunities for CBOs and NGOs to self-fund up-scaling. Other avenues for seed production need to be identified though to ensure that enough certified seed is produced through innovative farmers. Buy back schemes are another way in which the volume of seed available to extension services can be secured and this itself provides farmers by example with experience of seed production – perhaps the most important consideration in an up-scaling strategy. Currently, NARC produces 2814 kg of chickpea foundation seed and this is sufficient to cover the existing area but not more. In recognition of this problem, the NARC Outreach Programme has added the "frontline" demonstration method for pre-released varieties. In this process, researchers and extension staff interact directly with farmers in PVS/Farmer Field School (FFS). However, FFS have not been sustained beyond the project life and farmers tend to lose interest once the benefit stream from the projects dries up. The principal challenges of chickpea are the unavailability of the quality seed and the risks associated with unregulated farmer-produced seed. Furthermore, chickpea is perceived as high risk owing to recent nationwide crop failures (1997/98), and so considerable efforts need to be made to redress this perception. ICM of chickpea requires knowledge, which is thought beyond the interest of many farmers especially when alternatives such as wheat or lentils are available – and this is despite the fact that chickpea for yield and price per kilo is far superior to the alternative rabi crops.

Direct feedback from farmers

One farmer from Lalbandi – Krishna Kumari Shrestha reported that she had 200 kg of seed for distributing among farmers and that she was also helping

other farmers with information regarding the technologies. She also confirmed that Avarodhi had been self selected by them in participatory varietal selections. She also contradicted what many scientists were reporting about farmer perceptions about the high cost of investment for chickpeas. She reported that among the crops she grew which include vegetables, chickpea required the least investment. She also announced that chickpea was in fact the most successful crop in Lalbandi, Sarlahi district, that she had full faith in chickpea and that the whole village had benefited from the increased wealth it had generated.

Additional issues associated with upscaling of chickpea ICM

Zero tillage could be a useful additional option as discussed by Barry Pound earlier in these proceedings. It would allow earlier planting under some soil/climatic conditions, it might improve weed control and would bring in row planting that makes subsequent operations far easier (eg, spraying a randomly planted crop is difficult and inefficient.)

Summary of lessons learned

Economics

- Chickpea is a crop that can compete with alternatives. It is highly profitable with the right technology and can help improve livelihoods for poor farmers.
- If rewards are sufficient, farmers will adopt and reinvest (sustainable).
- Markets not a limiting step for chickpea in Nepal. Product must have a market opportunity especially with countrywide up-scaling.
- Connectivity between NARC and extension systems such as DoA essential.
- Storage a crucial and currently low priority for farmers and needs careful pest management.

Pest and disease management

- Pesticide quality crucial and adulteration frequently reported. Needs monitoring by DoA/NARC.
- Insecticide resistance reported in western parts of the country (possibly associated with cotton in neighboring India?). Needs addressing with alternatives.
- NPV could be used and works but no infrastructure for backstopping quality control or production, legislation and policy.

- Transgenic approaches may be considered (are being used in Bangladesh).
- Key life stages need to be understood and recognized by farmers.
- Farmers adopting chickpea as new crop did better if they had had previous experiences with similar technologies – ie, tomato to chickpea.
- Cross infection by BGM from other species occurs (eg, pigeonpea) therefore, broad thinking required for improved management.
- Careful skills of diagnosis need to be taught to farmers with well-informed technical backstopping.
  - Key life stages for successful control of insects essential.
  - Apparent resistance disguises actual susceptibility of the flowers to disease.
  - Early warning (eg, Calendula high susceptibility) and diagnosis
- Technologies too complicated for some farmers.

Seed production

- Chickpea is self-fertilizing. Once farmers have a variety, they can maintain their own seed stock negating long-term role of seed production SMEs in up-scaling.
- Always a need for technology inputs. We encourage low cost inputs – less financially rewarding for SME, therefore low interest.
- Self help groups increasingly take on the role of seed production. This works and helps ensure wider knowledge dissemination.

Crop diversity

- Crop diversity is valid to poverty alleviation but requires a strong focus on key technologies for each crop to ensure success of individual components
- Suitability of crop alternatives depends on agricultural conditions and farmer acceptability - both elements need to be clear.
- Adequate technical backstopping for new initiatives essential and often lacking.

Dissemination

- Popular media such as newspapers and television gives agriculture a low priority, so novel and alternative, local or traditional mechanisms need to be exploited to ensure widespread dissemination of information and knowledge.

References

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