The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization belonging to the Future Harvest Alliance of Centers supported by the Consultative Group on International Agricultural Research (CGIAR). Established in 1972, ICRISAT generates and shares cutting-edge technologies that support the livelihoods of more than 300 million people – the poorest of the poor in semi-arid areas of the developing world.

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ISBN 92-9066-482-7 Order code : IBE 070 639-05

A Strategy for Wealth Generation through Chickpea Production

Information Bulletin No. 70
Citation: Stevenson PC, Pande S, Pound B and Neupane RK. 2005. A strategy for wealth
generation through chickpea production. Information Bulletin No. 70. Patancheru 502 324,

This publication is an output from the Crop Protection Programme of the United Kingdom
Department for International Development for the benefit of developing countries. The views
expressed are not necessarily those of DFID.

R7885, R8336 Crop Protection Research Programme DFID.
A Strategy for Wealth Generation through Chickpea Production

Information Bulletin No. 70

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Acknowledgements

The authors wish to thank all the farmers across Nepal who have helped carry out the research and promotional activities for this paper.

We also thank the Honourable Minister, Secretary and Joint secretary, Ministry of Agriculture and Cooperatives, HMGN for supporting our work and similarly the Executive Director NARC and the Director General of DoA.

We would also like to thank the staff of NARC and DoA for their help and support in carrying out the work described here.
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Summary

This paper describes a new technology that can lead to significant improvement in the nutrition and income of poor farmers in the Nepal terai, but is broadly applicable to most of South Asia. The technology has been shown to double chickpea yields and double the profits made from growing it as a cash crop. Furthermore, it can remove most of the risks of crop failure that have reduced farmer confidence in the crop in recent years. The paper discusses what needs to be done to introduce this technology to 100,000 farming families (800,000 poor people) in Nepal, increasing their income by up to $270 ha\(^{-1}\) yr\(^{-1}\), and how to eliminate the need for imported chickpea.

Chickpea (Cicer arietinum L.) is a high value crop and a major component of the largely vegetarian Nepalese diet, providing a versatile source of protein for the rural and urban poor. Yet the area under chickpea production in Nepal has declined severely in recent years owing to persistent disease and insect damage that often results in crop failure, diminishing farmers’ confidence in the crop. Where it is grown and farmers are able to harvest some amount, yields are low at < 800 kg ha\(^{-1}\). But there is a solution to this problem.

The strategy uses improved cultivars (high-yielding & disease tolerant), ultra-low and judicial pesticide application (fungal & insect control), seed priming (to enhance germination and plant establishment), reduced fertilizer inputs (to prevent dense canopy & improve plant stand) and Rhizobium inoculation, where deficient, to improve plant growth (Pande et al. 2003a).

Chickpea is drought tolerant. Once it has germinated its deep roots ensure that it needs no further water other than residual moisture from kharif paddy, and so it is well suited to the dry rabi cropping of the West and far-western regions of Nepal, which are major geographic foci of the National Planning Commission’s (NPC’s) 10\(^{th}\) Plan Poverty Reduction Strategy Paper (PRSP).

An Integrated Crop Management (ICM) strategy has been evaluated by more than 3000 farmers across the Nepal terai on smallholder farms that more than doubles yields to over 2 t ha\(^{-1}\) (Fig 1) and, since the investment required is low, halves the unit cost of production, thus more than doubling profits (Table 1). More importantly, ICM guarantees a harvest.

<table>
<thead>
<tr>
<th>Table 1. Costs of production and income and unit cost of production of chickpea when using ICM technologies compared with traditional practice.</th>
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<td>Cost (NRs ha(^{-1}))</td>
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<td>------------------------</td>
</tr>
<tr>
<td>Total cost</td>
</tr>
<tr>
<td>Gross income</td>
</tr>
<tr>
<td>Net income</td>
</tr>
<tr>
<td>Unit cost Rs kg(^{-1})</td>
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</table>
A chickpea success story

Lalbandi is a village in Sarlahi district on the main East-West Highway of Nepal where the principal winter crops, until recently, were vegetables – notably tomato, a crop that requires huge capital investment by farmers for pesticides and fertilizer as well as irrigation. Yet even with the appropriate knowledge and technologies, farmland in Lalbandi and neighbouring villages was covered with tomato damaged by fruit-borer, late blight and fruit rot diseases. In 2000 we met farmers trying to sell tomatoes rapidly over-ripening in the afternoon sun at NRs 2 kg⁻¹, desperate to recoup their investments. All unsold produce perished.

This district was never a traditional chickpea-producing area; however, when offered chickpea as an alternative, with a low-cost, low-input and easily manageable package of integrated technologies, we found farmers were very keen to give it a go. Farmers were surprised at how little chemical input was required. The prospect of a high value and non-perishable crop with the potential to achieve yields of more than 2 t ha⁻¹ was attractive.

We gave 400 farmers about 1 kg each of seed of an improved variety in November 2002 – enough to sow approximately 1 katha (0.033 ha) in a participatory trial. The total area sown in the village was about 13 ha. Farmers were successful and took well to growing the new crop. Owing to their endeavours, along with focused promotion, informative field schools and technical backstopping, farmers more than doubled the production of chickpea compared with that being harvested elsewhere in Nepal using traditional methods and local varieties. The enthusiasm for the crop took Lalbandi by storm and through continued support and farmers’ initiative the total area sown in 2003 in Lalbandi rose nearly ten times to 110 ha (Fig 2).

In this village chickpea has rapidly taken over where previously tomato lay rotting in fields. Some individuals have achieved remarkable success in such a short space of time. Mrs Krishna Kumari Shrestha (Fig 3), one of our farm leaders in the village, achieved yields of more than 4 t ha⁻¹, illustrating chickpea’s immense potential. The crop can realize Rs 35-40 kg⁻¹ and so provides a highly valuable alternative to vegetable production. The value of the private sector to the sustainability of chickpea production in Lalbandi has also been considered. The project identified dealers in agriculture inputs, and helped develop market linkages with chickpea farmers. For example, guarantees with project farmers to buy 7000 kg of seed (enough to sow 233 ha) were set up by a local seed and agricultural technologies dealer. These were distributed in October 2004, along with the ICM information sheet and ICM technologies to new farmers, who continue to prosper.
Mechanisms for upscaling

The mechanisms required to upscale ICM have been identified through discussion with government institutions, NGOs, community-based groups and farmers. The areas that need addressing include:

- Recognition of chickpea as an income-generating crop
- Promotion of pulses through a more balanced subsidy system
- Seed availability, quality, cost and storage (through the formal and informal sectors)
- Further development of pest management technologies
- Action on pesticide quality
- Access to credit (convincing creditors about chickpea potential and economic viability)
- Developing chickpea as part of a farming system
- Marketing (linkages between farmers and market opportunities, farmer access to market information)
- Information materials production and dissemination (by a range of media)
- Advocacy and promotion of “champions” as success stories
- Fitting promotion of the new technology and farmer support mechanisms into the rigid bounds of NARC and DoA, and improving complementarity among GOs, NGOs, CBOs and private enterprises.

Figure 2. Farmers have almost entirely replaced tomatoes with chickpea as a major source of winter income in Lalbandi.
Currently Nepal imports up to 90% of its chickpea (Stevenson et al. 2004) but there is potential to expand this crop into the estimated 373,000 ha of winter rice fallow across the terai, particularly in the midwestern region. And this could increase farmer wealth by $270 ha\(^{-1}\) yr\(^{-1}\) and eliminate the need for importing chickpea.

The recommended technologies provide an economically and environmentally acceptable way to improve chickpea production. The impact on livelihoods has been substantial, with the majority of farmers reporting improvements in all aspects of domestic life. One dramatic change was the number of farmers moving from mud houses to brick houses or building them from scratch (5-10%). Up to 22% of farmers reported having paid off debts, and also increased spending on children’s education, clothes and healthcare. Over the course of the trial domestic expenditure increased by 45% and there was an increase in local employment, demonstrating how the ICM of chickpea directly addressed facets of the 10\(^{th}\) Plan (Pande et al. 2003 b & c).

This document explains what needs to be done at policy, strategy and field levels to achieve these improvements. The rewards for Nepal are import substitution, export promotion, improved human and livestock nutrition, enhanced soil health, and enhanced farmer wealth. Women farmers often manage chickpea production, so increasing its production is empowering for them. The 10\(^{th}\) Plan has included gender and equity as a cross cutting and sectoral issue emphasising its importance in current development planning for Nepal. This technology enhances women’s ability to play a greater role in farm management and profit from poverty-reduction opportunities.

**Purpose of the bulletin**

This bulletin describes how agricultural policy and strategy can support the rehabilitation and expansion of profitable chickpea production in Nepal. It presents ways to overcome the pests and diseases that are the afflict of chickpea. This information will assist Nepal’s NPC to directly address rural poverty as required under the 10\(^{th}\) Plan.
Target audience

The target audience for this document is individuals who are able to set and implement the policy changes necessary to achieve the overall goal of rehabilitation of chickpea production in Nepal, and elsewhere in Asia. Specifically the target individuals are:

**Nepal**

- Senior government policy setters in Nepal (HMGN), including Minister of Agriculture, Honourable Members of the National Planning Commission, Joint Secretaries MoAC & other senior policy makers in MoAC
- Executive Director, NARC (MoAC)
- Director General, DoA (MoAC)
- Livelihoods and rural policy advisors (DFID and other donors in Nepal)
- NGOs and seed and agricultural technology companies

**Worldwide**

- Key policy setters and research administrators in Bangladesh, India, Pakistan and Afghanistan; National Agricultural Research Stations (NARS) including Indian Council for Agricultural Research (ICAR)
- Research directors at international and national research institutes and organisations in Asia and Africa (including ICRISAT and ICARDA, ICIMOD, Asian and African Development Banks, IFAD, the World Bank and UNDP)

Background

Legumes are a very important component of rice cropping systems in Nepal and provide essential winter production for poor farmers from rice fallows. Chickpea is particularly important because it has a deep root system and thus once established is drought tolerant and requires no irrigation. Legumes enhance soil fertility through nitrogen fixation and the maintenance of soil organic matter. Reduction in the planting of leguminous crops has had a negative impact on the sustainability of the cereal-based systems. The area sown to chickpea in Nepal has declined from more than 54,000 ha in 1981-82 to 19,000 ha in 1997-98 (Pande et al. 2005). This is largely due to the reluctance of farmers to invest time and money in a crop that increasingly fails, primarily due to disease and insect pest problems. A consequence is the decline in grain legume consumption to about 25% of the level recommended by FAO (10 kg capita⁻¹ yr⁻¹ (Pandey et al. 2000)). Owing to severe crop failures, especially in the 1997/98 season, up to 90% of chickpea consumed in Nepal is now imported (Johansen 2001).

The area under chickpea in Nepal has declined by 80% over the last 25 years because pests and diseases can totally destroy the crop and farmers no longer have faith in its production. This has increased the demand for imported seed and may impact upon nutrition.

Problems facing chickpea production

Farmer surveys between 1998 and 2003 have all led to the same conclusions about the problems facing chickpea production in Nepal. These can be summarised as follows:

- Pests and diseases: Result in low yields and crop failure
- Quality seed and varieties: Not available
- Agronomic practices: Inadequate
• Pesticides: Adulterated or ineffective
• Knowledge of IPM: Poor
• Seed losses: High due to storage problems

Of these, **by far the most significant problem according to farmers is pests and diseases**, notably fusarium wilt (*Fusarium oxysporum* f. sp *ciceri*), botrytis grey mould (*Botrytis cinerea*) (Fig 4) and pod borer (*Helicoverpa armigera*) (Fig 5). The last is known locally as Kira Bahadur or “brave insect” owing to its resilience and persistence.

**Fusarium wilt**: Disease resistance in improved varieties has largely taken care of the problem of wilt, provided seed is available to farmers. However, farmers should be discouraged from growing chickpea in the same field for several successive years to avoid the build up of wilt complex.

**Botrytis grey mold (BGM)**: Although foliar resistance to mold is present in improved varieties, flowers are invariably still susceptible (Fig 4) when conditions are right, and the flower drop caused by this disease is one of the two major problems affecting chickpea production in Nepal. BGM has in the past led to complete crop failure, notably in 1997/98. BGM usually occurs when the nights are cool and fog remains for most of the day for several days. This may occur from mid-December through to mid-January but is most serious in January when the crop is flowering.

**Pod borer**: The pod borer emerges as the major pest threat where BGM has been controlled or when conditions have not been conducive to BGM infection. Outbreaks tend to occur from mid-March. The pest burrows into the pod and consumes the pea. With the potential for borer population explosions, the outcome is usually devastating for the crop. Heavy use of pesticides across the region to control this widespread insect, especially in cotton growing regions, has exacerbated its pest status by reducing natural enemies and increasing insecticide resistance (Johansen 2001, Armes et al. 1992). Furthermore, locally available pesticides are frequently adulterated and their use means that farmers are using poor quality materials that do not

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**Figure 4.** Botrytis grey mould (*Botrytis cinerea*) can cause total loss but often only infects flowers so is difficult to diagnose before it’s too late.

**Figure 5.** *Helicoverpa armigera* (pod borer) is a devastating pest of chickpea.
control the pest and further encourage the development of pesticide resistance.

Other agronomic problems in chickpea production include boron deficiency, identified as a cause of flower drop, which results in significant yield losses (Srivastava et al. 1997). Germination and nodulation are often low, indicating poor quality seed and lack of availability of appropriate Rhizobium (Johansen et al. 1994). Early crop establishment is also a limiting factor but can be overcome by seed priming, a very simple practice of seed soaking that can increase yields as previously demonstrated by a DFID-supported research project (Harris et al. 1999).

Components of the solution

The technology

A set of technologies has been tried and tested by farmers to overcome these constraints. They have proved effective in achieving successful and productive chickpea crops under farmers’ conditions with a minimum of training. The technologies should be equally effective elsewhere where similar climate and conditions prevail, such as the Barind tract in Bangladesh.

The package requires:

Improved varieties: Wilt resistant, BGM tolerant and high yielding; selected by farmers using participatory variety selection (Avarodhi and Tara).

Seed treatment: Seed priming, Rhizobium treatment (inoculum @ 3 g kg⁻¹ seed) and fungicidal treatment (Thirum + Bavistin (1:1 ratio) @ 2 g kg⁻¹ seed).

Fertilizer & spacing management: (DAP (di-ammonium phosphate @100 kg ha⁻¹)/Urea or FYM) to prevent dense canopy that encourages BGM & reduces flowering.

Very low chemical application (1 or 2 applications only): Judicial fungicide treatment when cool & misty (Bavistin @ 1g L⁻¹ water; 17 L katha⁻¹), & once or twice with insecticide (Thiodan @ 3 ml L⁻¹ water 17 L katha⁻¹), but only when insect threshold is superseded¹.

Storage: Sun drying, naphthalene, Neem, sealed storage containers.

Training, resources and support

Farmers are introduced to the package via field schools (Fig 6) and, while many farmers are interested, incentives are still worth considering to encourage farmers to attend.

Figure 6. Farmer field schools provide opportunities for information dissemination and building confidence with farmers.

¹. larval threshold is 1 larva m⁻¹
Fortunately, the technologies do not require expensive outlays (see box). A simple hand pump for smallholders (Fig 7) can cost as little as NRs 140 (= $2.00) and the entire package for a trial area of 1 katha (=0.033 ha) costs a further NRs180 for the seed and all inputs.

These inputs provide much greater assurance against crop failure and more than double farmers yields compared to traditional management.

Farmer surveys revealed that profits gained directly from chickpea production contributed towards major improvements in domestic and agricultural livelihoods (Fig 8) and furthermore that this additional income led to increases in productivity and employment (Fig 9).

**Figure 7.** A simple hand pump sprayer can cost as little as $2.00 (NRs140)

**Figure 8.** Domestic and agricultural expenditure of profits gained from chickpea according to farmers surveyed in Mid-west and Central regions.

<table>
<thead>
<tr>
<th>Mini-kit cost for 1 katha (0.033 ha)</th>
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<tbody>
<tr>
<td>Seed – 1.5 kg</td>
</tr>
<tr>
<td>Rhizobium</td>
</tr>
<tr>
<td>Fertilizer (DAP)</td>
</tr>
<tr>
<td>Fungicide for BGM</td>
</tr>
<tr>
<td>Insecticide for pod borer</td>
</tr>
<tr>
<td>Plastic storage bag</td>
</tr>
<tr>
<td>Information leaflet</td>
</tr>
<tr>
<td><strong>Total =</strong></td>
</tr>
</tbody>
</table>
The benefits to farmers’ livelihoods have been presented in detail in Pande et al. (2003 a & b).

**Vision**

Agriculture is the lead sector in Nepal’s national economy, accounting for about 42% of GDP (FAO 2005). About 80% of the population is engaged in agriculture. Land holding per family of 5-6 members in the terai is about 1.8 ha. The potential countrywide impact of grain legume production is vast – there are approximately 138,000 ha of rice fallow in the western regions of Nepal that could be used for this purpose. The West is very dry in the winter, and thus chickpea would be the most suitable crop for this purpose. The current area of production – 10,000 ha – provides only 10% of Nepal’s national requirement (Pande et al. 2005), suggesting that there is a huge need for increased production and markets will not be a limiting factor.

**Policy and strategy areas**

The process of scaling up chickpea production has two dimensions:

- **Horizontal scaling up:** Extending the coverage of the technology over a wider geographic area and a greater number of people.
- **Vertical scaling up:** Incorporating the technology into the structures, processes and practices of relevant research, development and commercial institutions.

In developing this strategy we have considered equity, the heterogeneity of clients, and the sustainability (institutional, financial and environmental) of the technology. It will be imperative to maintain good monitoring and evaluation throughout the process of scaling up.

The potential value of ICM to dramatically increase productivity of chickpea, encourage the restoration of chickpea as a major legume for winter cropping, and help alleviate poverty among the rural poor of Nepal has been proven, and the mechanisms by which this can be achieved are acceptable to farmers and have been adopted by them successfully – in some cases very impressively.

**What is currently in place to enable up scaling?**

NARC has played a key role in developing this successful technology, notably through its strong collaborative ties with ICRISAT, and will continue to play an important part in supporting the scaling up process. However, the principal extension role of expanding the geographic focus of the technology will need to be taken up by others who are already equipped with the links, staff and expertise required. These will include the Department of Agriculture (DoA) and NGOs and small and medium enterprises with a commercial interest in the sale of inputs and the marketing of products.
Scaling up the technology package will need to go beyond mini-kits, as the technology requires farmers to understand the links between seed, pests and agronomic practices to achieve good yields, and to be able to make best use of opportunities for value addition and marketing.

Thus, while the distribution of mini-kits will be a valuable tool, the successful application of the technology will require a process of familiarisation and teaching for farmers through farmer field schools. The capacity to do this needs to be built into DoA extension plans through training-of-trainer workshops before the mini-kits can be distributed widely.

### Policy support: Government and Institutional

#### 1. Policy
The pay-offs for policy support include import substitution, food security, poverty alleviation, promotion of export, soil health enhancement, and improved livestock nutrition.

**i) Enabling policy environment**
Chickpea crop enhancement and R&D needs to be made a national priority within the national agricultural strategy. This will facilitate the strengthening of institutional and manpower capacity for technology support along with further technology development.

*Action: Minister/Joint Secretary*

**ii) Seed access enhancement**
Availability of improved varieties needs to be enhanced at an institutional level through appropriate investment of funds and manpower through

a) enabling NARC as the principal seed source (production and distribution);
b) strengthening community-based seed production systems through funds and technical backstopping; and
c) encouraging SMEs, through financial incentives, to stock and promote improved chickpea varieties.

The financial mechanisms for (c) need to be authorised at ministerial level, but DoA and NARC could raise the request for these funds through the usual fiscal processes.

**iii) Crop insurance**
Farmers have all but given up on growing chickpea using traditional methods of production and so need encouragement to invest time and money in new approaches. As mentioned in the 10th Plan, a mechanism of crop insurance could provide the assurance needed for the level of commitment that will be required from farmers.

**iv) Zonation of rice fallows**
Target areas in the rice growing regions should be identified, and the inclusion of lowland maize fallows in the up scaling process considered. This will need further research carried out through farmer participatory trials conducted by the National Research program.

**v) Technology support and enhancement**

a) Subsidies for chemicals and equipment will better enable resource-poor farmers to initiate production of chickpea. This need not be costly since the technologies are relatively low cost (see box) and hand pump sprayers can be made for as little as NRs 120 according to farmers in Sarlahi (Fig 7).

b) Some farmers stated that *Rhizobium* was expensive and unavailable and this problem needs addressing. Perhaps all seed from NARC can be inoculated as a matter of course before being provided to farmers.
c) Alternatives to chemical control
Increasing concerns about insecticide resistance and environmental issues justifies the need to focus on alternatives. The value of the biological pesticide nucleopolyhedrovirus (HearNPV) in controlling pod borers was validated successfully through farmer participation. Hear NPV is a highly specific viral disease of the pod borer that causes death within a few days of contact from the virion (Fig 10). In several areas, especially on the improved variety Avarodhi, HearNPV was more effective than Thiodan, the insecticide provided to farmers to control the insect. HearNPV is clearly a viable and eco-friendly alternative to chemical-based pesticides and should be promoted widely once production difficulties are overcome. Production facilities should be established in Nepal to ensure that this alternative option is available to farmers. There are several models of local production including farmer production, village production, state or extension service production and commercial private sector production, which need to be evaluated for adoption in Nepal. A national system of regulation for NPV would also need to be developed and legislation to allow importation would need to be understood.

Ultimately, the potential for NPV to influence agriculture in Nepal needs senior government support to enable the process. Capacity building in these developing technologies is required, although limited expertise already exists in NARC and the NGO FORWARD.

The potential for testing genetically modified chickpea on station under controlled conditions needs to be considered from both an ethical and practical perspective.

2. Funding – where will it come from?
Funding should be provided from regular agricultural budgets. Activities of extension providers such as NGOs, SMEs or community-based groups (CBOs) could be financed through District Agricultural Development Funds (DADF) of the Agricultural Perspective Plan Support Programme (APPSP) under two sub-funds – the Local Initiative Sub-Fund (LIF) and the District Extension Sub-Fund (DEF). These funds are designed to strengthen decentralised service delivery, streamline agricultural interventions in remote areas, promote public-private partnerships and provide opportunities for HMGN grassroots line agencies, CBOs and local farmer groups to work together, and enable the government agencies to change their role from implementers to facilitators.

Additionally, HMGN established the National Agricultural Research and Development Fund (NARDF) in order to involve the private sector, NGOs, civil society and the public sector in promoting and implementing agricultural research and agricultural development activities for the benefit of farmers and the improvement of their livelihoods. The promotion and implementation of ICM of chickpea would fall under this category. Notably, the fund is for marginalised, socially excluded and
disadvantaged farmers living in both hill and terai regions of the country.

**Seed multiplication and distribution**

The six improved varieties of chickpea that are being piloted have not yet reached foundation seed stage. Avarodhi, perhaps the most impressive in farmer participatory varietal selection trials, has been developed in India and has been tested for 3-4 years. The test results need to be submitted to the National Seed Board (NSB) so that the varieties can be approved for release.

Two main models exist for multiplication of seed and making it available to farmers; the *formal* and *informal* (community-based) seed sectors – the latter being larger but less controlled.

NARC stations, DoA farms, National Seed Company (NSC), private seed companies and some NGOs comprise the formal seed sector and all will contribute to seed provision. However, NARC will play a key role in early stages of multiplication and will be the principal provider for seed multiplication. The seed provision model consists of breeders’ seed (provided by NARC), foundation seed (provided by NARC along with qualified private organisations), certified seed (provided by NARC, seed companies, farmer groups) and truthfully labelled seed provided by seed companies, CBOs and individual farmers. The informal sector comprises CBOs, farmer groups and individual farmers who provide at the farmer-to-farmer level.

The formal sector needs to maintain its advantage in terms of quality and purity control over the informal sector and also its institutional accreditation. However, improvements must be made in terms of the supply of seed at the right time. Without a commercial incentive it is difficult to see how this could be achieved. Questions of price fixing also need to be addressed. Profits drive the informal seed sector, which is thus able to provide timely delivery of good quantities of seeds because it is demand driven. However, infrastructural changes are needed to enable the development of mechanisms that address quality issues and price.

Clear roles should be assigned for each stage of seed provision.

NARC, DoA and NSB/NSC can focus on
1. quality control
2. market links
3. source seed
4. dissemination
5. variety release
6. price setting
7. maintenance
8. coordination
9. training

NGOs can take on the role of
1. scaling up
2. formation and mobilisation of CBOs
3. varietal development
4. training
5. market links
6. technology input and supply

CBOs can play a large role in
1. seed production and distribution
2. farmer to farmer training
3. participatory varietal development
4. sales & distribution of technologies.

Private organisations and SMEs can
1. market and sell seed
2. distribute and sell technologies
3. distribute and sell information.
**Information supply**

Information supply is a key facet to the strategy and its importance cannot be overemphasized. Pictorial training materials for farmers have already been developed (Fig 11). However, these could be further developed in a more location-specific manner, and to differentiate between resource-rich and resource-poor farmers. Audiovisual aids could be useful and their use needs to be further explored. More than 40% of GDP comes from agriculture, and yet less than 5% of media attention is focused on it. National and local TV needs to be better exploited, with informative approaches to dissemination. FM and local radio could be made more useful owing to its countrywide reach. Similarly, low-technology local dissemination by local enthusiasts can be encouraged through village level newspapers, wall posters and PA systems in local *melas*, etc.

**Feedback mechanisms**

It is equally important to ensure that communication works both ways and the needs and concerns of the ultimate stakeholders – the farmers – need to be monitored continuously. This will engage them in developing the strategy as it expands. Initial experience of this has proved highly valuable in developing the ICM technology. Some of their feedback is highlighted below.

**Lessons learned**

As with all development projects, farmer consultation is essential in ensuring workable and valid development activities through direct consultation. Farmer feedback on the project that led to this paper has been hugely valuable in drawing up the strategy. Continued technical feedback and travelling seminars are always requested by farmers and can help to develop and improve the strategy and also ensure that farmer initiatives are appropriate (e.g. combining BGM and insect treatments, which is currently practised by some farmers to save time, is actually not recommended owing to timing of biotic outbreaks). Farmers also suggested that as a community they were unified and would themselves be able to train other farmers if funds were available such as the LIF (APPSP), as discussed above. Specifically, farmers highlighted their role in the community as being helpful, providing training and local level leadership, and selling seed to other neighbouring communities/farmers. Along with community-based development they also identified the need for chickpea producer groups to ensure the sustainability of chickpea production and marketing. New farmers will be convinced most effectively by having the economic benefits demonstrated but will also need product marketing help and need to be convinced that the crop can be grown without irrigation. The training booklet with fact sheets already provided was praised by farmers and emphasis on its importance in the adoption was stressed. Perhaps most important of all, our experienced farmers reported that there were currently no problems with processing or marketing the crop although there will be a need to address marketing if production of the crop takes off.

Additional areas highlighted by farmers include the need for more help in seed selection, storage and treatment – especially with *Rhizobium*. NARC (Khumaltar) can offer this facility cheaply and this technology should be mobilized immediately to reap the benefits of additional nutrition through nitrogen fixation.

Farmers showed considerable interest in NPV and reported that inputs in terms of
Figure 11. Farmer information sheet describing the problems and providing clear descriptions of solutions.
local production, importation, legislation and technical backstopping need to be invested in NPV for it to truly make a difference.

**Lessons learned from CPP farmer promotion and adoption of ICM**

**Economics**
- Chickpea competes well with alternatives, is highly profitable and can improve livelihoods for poor farmers and their families.
- If rewards are sufficient farmers will adopt and reinvest.
- Markets are not limiting for chickpea in Nepal. Connectivity between the extension system (e.g., DoA and NGOs) and NARC is essential.
- Good storage is crucial and currently a low priority for farmers – needs pest management.

**Pest and disease management**
- Pesticide quality is important and adulteration frequently reported. Needs monitoring.
- Insecticide resistance reported in West (associated with Cotton India?). Needs addressing with alternatives.
- NPV works but no infrastructure available for backstopping, quality control, production, legislation and policy.
- Transgenic approaches may be considered (being done in Bangladesh).
- Diagnostic skills need to be taught to farmers, with technical backstopping.
  - Key life stages of insects essential for successful control.
  - Apparent resistance (in whole plant – i.e. of the leaves) disguises actual susceptibility of the flowers to disease.
  - Early warning (e.g. Calendula high susceptibility)/diagnosis
- Technologies too complicated for some farmers.

**Seed production**
- Chickpea is self-fertilizing. Once farmers have a variety they can maintain their own seed, negating role of seed SMEs.
- Always a need for technology inputs. We encourage low cost inputs – less financially rewarding for SME therefore low interest.
- Self-help groups to take on role of seed production. This works & helps ensure wider knowledge dissemination.

**Crop diversity**
- Crop diversity is valid to poverty alleviation but requires 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 need clarity.
- Adequate technical backstopping for new initiatives essential & often lacking.

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

**Overall programme leadership**
Overall, the lead for this major project should be top-level management in DoA in cooperation and collaboration with NARC and the NSB/NSC along with technical support from outside organisations such as NRI and ICRISAT. DoA has a broad and community integrated extension network; however it will still depend heavily for the broadest uptake on
NGOs and small private sector companies and in planning up scaling should enable this component through established NGOs and Agrovets and well-informed local group leaders.

Additionally, the best support for farmers, especially those new to the technologies, would be to enable local leadership through paid village extension workers or cost of which could be borne by subscription or profits from outputs. The forerunner project enabled one of these in Lalbandi and the subsequent benefits to the project in that village and Bardibas were considerable as described above. This individual would be able to help farmers locally with information about timings for applications, diagnosis of disease, approaches to other inputs such as fertilizer and plant spacing as well as avenues for marketing. The overall lead for this village level dissemination of knowledge and technical backstopping could be managed directly by a donor such as the DFID.

Implications for national development

The success of this strategy will necessitate government investment. But this investment will reap considerable reward and the potential impact should not be underestimated. The development implications for Nepal of a dramatic increase in chickpea production would be greater wealth, improved livelihoods and empowerment of some of the poorest people in the country. Empowerment enhances the ability of poor or disadvantaged people to realize their potential and ambitions and especially enables the poor to take advantage of poverty-reduction opportunities by strengthening their sociocultural and economic capabilities. Many women are involved in chickpea farming because it is a winter crop – a time when men traditionally migrate to find employment in labour markets such as the building trade. Empowering women with increased production of chickpea would enable more women to exert influence over the activities of family and village life. The 10th Plan has included gender and equity as a cross cutting and sectoral issue and the rehabilitation of chickpea could help enable this.

Final word

Carefully considered implementation of chickpea ICM will dramatically improve the lives of poor farmers in Nepal. Equally important, ICM guarantees a chickpea harvest.

References


# Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>APPSP</td>
<td>Agricultural Perspective Plan Support Programme</td>
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<td>BGM</td>
<td>Botrytis grey mould</td>
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<td>CBO</td>
<td>community-based organisations</td>
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<td>CPP</td>
<td>Crop Protection Programme of DFID</td>
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<td>DEF</td>
<td>District Extension Sub-Fund</td>
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<td>DFID</td>
<td>Department for International Development</td>
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<td>DoA</td>
<td>Department of Agriculture</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>FYM</td>
<td>farmyard manure</td>
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<td>GOs</td>
<td>government organisations</td>
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<td>Ha</td>
<td>hectare</td>
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<td>HMGN</td>
<td>His Majesty’s Government of Nepal</td>
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<tr>
<td>ICARDA</td>
<td>International Center for Agricultural Research in the Dry Areas</td>
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<td>ICIMOD</td>
<td>International Centre for Integrated Mountain Development</td>
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<td>ICM</td>
<td>Integrated Crop Management</td>
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<td>ICRISAT</td>
<td>International Crops Research Institute for the Semi-Arid Tropics</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IPM</td>
<td>Integrated Pest Management</td>
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<td>LIF</td>
<td>Local Initiative Sub-Fund</td>
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<td>MoAC</td>
<td>Ministry of Agriculture and Cooperatives</td>
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<td>NARC</td>
<td>Nepal Agricultural Research Council</td>
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<td>NARDF</td>
<td>National Agricultural Research and Development Fund</td>
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<td>NARS</td>
<td>National Agricultural Research Station</td>
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<tr>
<td>NGO</td>
<td>nongovernmental organisation</td>
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<td>NPC</td>
<td>National Planning Commission (Nepal)</td>
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<td>NPV</td>
<td>Nucleopolyhedrovirus</td>
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<td>NRI</td>
<td>Natural Resources Institute (UK)</td>
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<td>NSB</td>
<td>National Seed Board</td>
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<td>NSC</td>
<td>National Seed Company</td>
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<tr>
<td>SME</td>
<td>small or medium enterprise</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
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This publication is an output from the Crop Protection Programme of the United Kingdom Department for International Development for the benefit of developing countries. The views expressed are not necessarily those of DFID.

R7885, R8336 Crop Protection Research Programme DFID.
The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization belonging to the Future Harvest Alliance of Centers supported by the Consultative Group on International Agricultural Research (CGIAR). Established in 1972, ICRISAT generates and shares cutting-edge technologies that support the livelihoods of more than 300 million people – the poorest of the poor in semi-arid areas of the developing world.

About ICRISAT

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ISBN 92-9066-482-7
Order code: IBE 070
639-05