Integrated Pest Management (IPM) in Grain Legumes in Asia

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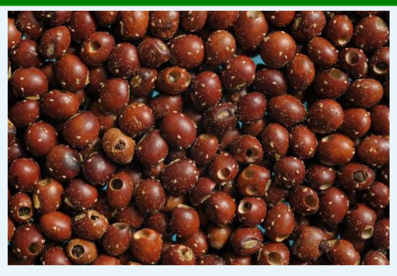
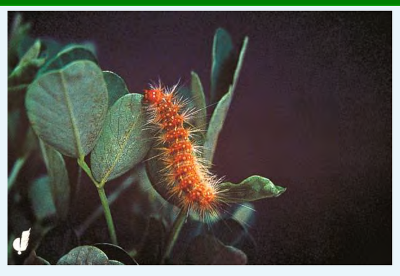
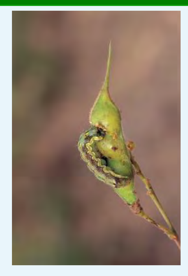


Callosobruchus sp.



Amsacta albistriga



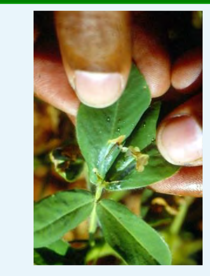
Helicoverpa armigera

Maruca vitrata

Holotrichea serrata

Odontotermes sp.

Spodoptera litura



Aproaerema modicella

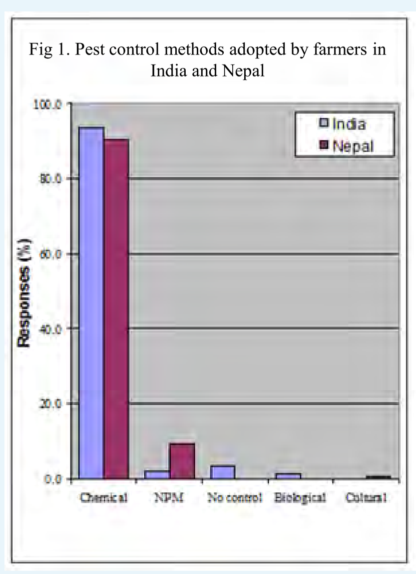
Aphis craccivora

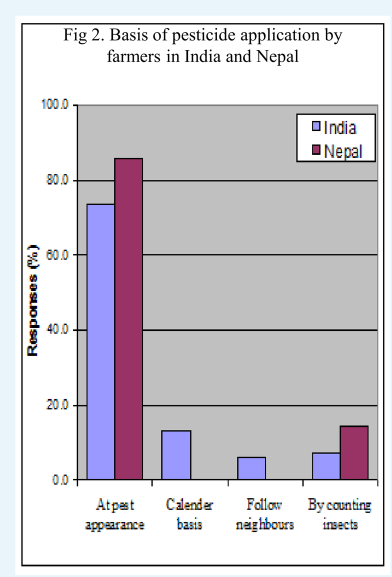
Caryedon serratus

Abstract: Insect pests are a major constraint in legume production and storage. Legumes pests are often sporadic, and at times cause complete destruction of crops. There has been a shift in pest spectrum in Asia over the past five decades. The relative severity of polyphagous pests such as red hairy caterpillar, *Amsacta albistriga,* white grub, *Holotrichea serrata*, and leaf miner, *Aproaerema modicella* has decreased in groundnut; while beet armyworm, *Spodoptera exigua* in chickpea, spotted pod borer, *Maruca vitrata* in pigeonpea, thrips as vectors of viral diseases in groundnut, and termites have become a serious threat in the production of grain legumes. The importance of cotton boll worm/ legume pod borer, *Helicoverpa armigera* and tobacco caterpillar *Spodoptera litura* has remained unchanged. In general, virus vectors (thrips, aphids and mites) and the pulse bruchid, *Callasobruchus chinensis* and the groundnut bruchid, *Caryedon serratus* have become more serious. Research at ICRISAT in cooperation with NARS and NGOs in a participatory approach has emphasised utilization of pest-resistant cultivars, adoption of potential agronomic practices, and augmenting natural enemies. Several indigenous plant protection practices were brought to the forefront to enhance the productivity of grain legumes along with environmental and operational safety.

Shift in the economic status of major legume pests in Asia.

Scientific name	Shift in economic status		
	1970	1990	2014
Helicoverpa armigera (Hubner)	+++	+++	+++
Melanagromyza obtusa (Malloach)	++	++	++
Maruca vitrata (Geyer)	-	+	+++
Clavigralla gibbosa Spinola	-	+	++
Agrotis ipsilon (Hufnagel)	-	++	++
Aproaerema midicella Deventer	+++	++	+
Amsacta albistriga Walk.	+++	+	-
Spodoptera litura (Fab)	+++	+++	+++
Thrips palmi Karny Hood	-	+++	+++
Aphis craccivora Kouch	+++	+	-
Odontotermis sp	-	-	+++
Holotrichia serrata (Blanch)	+++	++	+
Callasobruchus chinensis (Fabricius)	++	++	+++
Caryedon serratus Oliver	+	++	+++

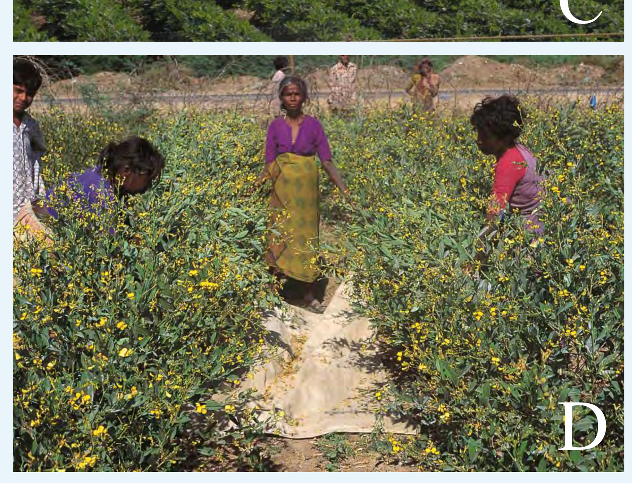




Introduction: Insect pests are one of the major limiting factors in enhancing and sustaining production of grain legumes in Asia. There is an increase in crop losses despite the increased use of plant protection chemicals. There is a concern about the adverse effects of toxic chemicals on health, environment and natural resources. Interactions with the farming communities revealed that 93% of the farmers in India and Nepal had adopted chemical control (Fig. 1), 51% farmers get their plant protection advice from pesticide dealers, and 22% from extension officials. Majority of the farmers (73%) initiate the plant protection based on the first appearance of the pest, irrespective of their population, crop stage, and their damage relationships (Fig. 2). Though integrated pest management (IPM) has been advocated for the past two decades, only 3.2% of the farmers adopted IPM practices in various crops. It is imperative that the negative effects of synthetic chemicals need to be minimized, if not eliminated completely, by strict adoption of eco-friendly approaches in plant protection before the situation goes out of control.

Effect of cultural practices on the management of insect pests and natural enemies

- Polyethylene mulch in peanut reduced thrips damage to 4.6% compared to 24.3% leaflets damage in un-mulched area. This also reduced jassid injury to 11% damaged leaflets compared to 21% in un-mulched area (A).
- Adoption of sunflower as trap crop in peanut and chickpea reduced *Spodoptera* populations in peanut and *Helicoverpa* populations in chickpea, with a 50% reduction in insecticidal application (from 2 to one spray) (B).
- Overhead irrigation reduced mite population in peanut by 80% overnight (6323 to 1282 mites per 50 leaflets) (C).
- Manual shaking of pigeonpea crop helped in the reduction of 95% pod borer *Helicoverpa* larval population in pigeonpea instantaneously (D).
- Timely application of only water sprays reduced the incidence of groundnut leafminer and coffee mites in Myanmar.
- Intercropping peanut with soybean enhanced the leafminer larval parasitization from 36-48% and reduced the pest population to 46 larvae compared to soybean 183 M^{-2}.



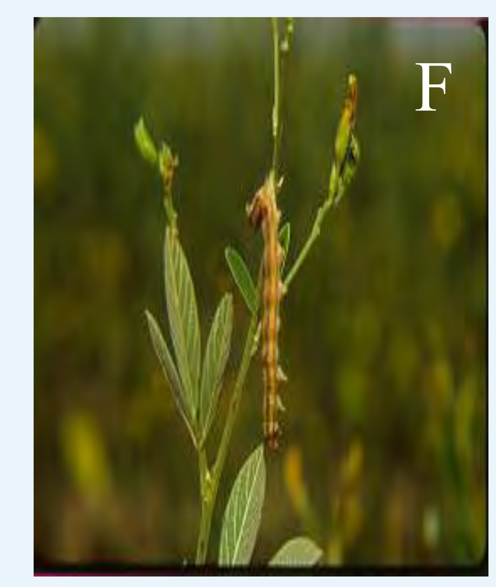
(A) Polythene mulch, (B) Sunflower as trap crop in peanut, (C) Overhead irrigation, and (D) Manual shaking in pigeonpea.

Host plant resistance in pest management

- In pigeonpea ICPL 332, ICPL84060, ICPL187-1 and ICP 7203 were found to be resistant to pod borer *Helicoverpa*. ICPL 98003 was found resistant to *Maruca vitrata.*
- In chickpea, ICC 506 EB, ICCV 10, and ICCV 7 were resistant to pod borer *Helicoverpa.*
- In peanut, ICGV 86031 and 86590 were resistant to *Spodoptera* defoliation, ICG 5240 for aphids, ICGV 86031 for leafminer, *Aproaerema,* (E) IGG 2271 for thrips and termites and ICG 5041 and 5043 to Jassids.

Bio-pesticides

- Neem and NPV products were developed (F), evaluated and shared with farmers for use in different cropping systems.
- Village based NPV units (100, in India & Nepal) established after training the farmers and extension personnel.



Impact of IPM in on-farm fields

- 7-40% of the total inputs on crop production are for crop protection.
- IPM resulted in 22-84% reduction in pesticide use.
- There are several IPM, as well as pesticide free villages in Asia.
- Strict adoption of IPM lead to reduction in contaminated natural resources (water bodies) to residue free (Kothapalli, Telangana, India).

Reduction in pesticide use in IPM villages

Village	Cost reduction in IPM over farmer's practice (%)
Hamsanpalli	21.5
Bollibaithanda	36.1
Chincholi	46.9
Kanjar	55.8
Punukula	55.0
Itagi	41.6
Ashta	All the farmers adopted IPM
Marlabeed	84.1

Conclusions / way forward

- **Investment** in development and implementation of plant protection research need to be enhanced to arrest further degradation of natural resources due to toxic residues and reduce environmental hazards.
- **Develop capacity** at the farm level to impart better knowledge in pest management in IPM.
- **Intensive monitoring** of crops at the vulnerable stages by effective means and linking it to **weather based** advisory system.
- **Periodic** pest and disease surveys to **update** the **knowledge on pest** incidence, distribution, and economic importance in different geographic regions, with **farmer's participation.**
- **Review of knowledge** on emerging and invasive species periodically to have adequate information ready for their management.
- **Variable climate** will result in uncertainty in decision making in IPM. Therefore, emphasis should be placed on identifying insect-resistant cultivars, effective cultural operations, cropping systems, natural enemies, and synthetic insecticides that are less sensitive to climate variability are necessary for sustainable crop production.

References

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