

PROMOTING SAFER & MORE SUSTAINABLE ALTERNATIVES TO CHEMICAL PESTICIDES

IMPROVING THE LIVELIHOODS OF SMALL FARMERS IN IRAQ THROUGH INTEGRATED PEST MANAGEMENT



This initiative promotes sustainable and safer approaches to the management of date palm pests in Iraq, helping to ease farmers from their dependence on chemical sprays while boosting productivity and incomes.

Key Messages

- Date palm quality and productivity have been deteriorating in Iraq during recent decades. In addition to the impacts of conflict and sanctions, efforts to increase yields are undermined by destructive pests, particularly Lesser Date Moths, Dubas Bugs, and Stem Borers.
- The most common means of dealing with these pests is the application of chemical pesticides, but this strategy comes at a considerable cost for both human health and the environment.
- This IFAD-funded research initiative demonstrates that sustainable and integrated methods of pest control are not only an effective alternative to the chemical pesticide spray option, but are also capable of generating higher yields and raising incomes.

Background: Date Palm Production in Iraq

Agriculture plays an important role in Iraq's economy, employing more than 40 per cent of the country's population. Although Iraq was once self-sufficient in many agricultural commodities, years of conflict, sanctions and political instability have caused significant declines in productivity. Today, Iraq faces a food deficit: local production only partially meets demand and it is estimated that the country will need a total of 3.5 billion USD to import food during the next decade.

A key commodity in Iraq is date palm, an integral component of irrigated farming systems in central and southern parts of the country. In addition to its nutritional value, date palm is also an important source of feed and fuel, and can be used as a building material in the construction of houses. It is therefore a significant contributor to household income in rural areas.

Despite this economic importance, the number of date palm trees has decreased considerably in recent decades. There are now only 18 million date palm trees in Iraq – half the number in the early 1960s. Beyond the effects of war and sanctions, production is also constrained by

pests: the Lesser Date Moth, the Dubas Bug, and various species of Stem Borer. Average yields in Basra rarely exceed 35 kg/tree, and while they may be higher in Baghdad – at 81 kg/tree – yields are still significantly lower than the averages in neighboring countries.

Farmers usually apply chemical pesticide sprays to contain the threat of pests. However, this strategy can be highly problematic: it is rarely cost-effective, threatens human health, and can damage the viability of agro-ecosystems. Pests capable of developing resistance to pesticides also trap farmers on an irreversible 'pesticide treadmill' since eradication requires more and increasingly toxic inputs. Safer and more sustainable alternatives are therefore desperately needed.

Tackling the Threat of Pests - Sustainably

This project, funded by the International Fund for Agriculture Development (IFAD), aims to improve livelihoods and empower smallholder farmers through the adoption of improved technology packages based on integrated pest management (IPM). This practical and environmentally-friendly approach to pest control combines an extensive range of techniques to control

and prevent the growth and spread of pest populations. It emphasizes the use of cultural and biological interventions, and supports the targeted use of pesticides only when alternative methods have been exhausted, costs are not excessive, and there is no threat to existing agro-ecosystems.

Activities are focused on two agro-ecological zones in central and southern Iraq. Both regions have experienced significant crop losses due to depleted soil fertility and the spread of disease and pests. To reverse this situation, ICARDA and its national partners are testing, refining, and transferring technology packages to farmers active in irrigated date palm production systems. Through farmer field schools and demonstrations, smallholder farmers are equipped with the knowledge and tools to remove the threat of pests, boost their yields and profits, and conserve the natural resource base.

Project Impacts:

- IPM interventions caused the population density of Stem Borers to decrease by 90.5% between 2009 and 2012; yields increased by 31% over the same period
- Depending on environmental factors, the biological agent *Bacillus thuringiensis* reduced infestation levels of Lesser Date Moth by 33-80% after two weeks of treatment, and 38-78% after one month; subsequent yield increases ranged from 16 to 115%
- The application of neem and neem-summer oil demonstrated efficacies of 96.6 and 96.7% against Dubas Bug infestation
- Expected economic impacts are significant: farmers currently using chemical pesticides could see their combined incomes increase by up to 37.6 million USD annually if they adopted IPM; those who are not currently using control methods could potentially earn an extra 75 million USD per year.
- Recommended policies will support the implementation of IPM: shifting subsidies from chemical pesticides to alternative inputs conducive to IPM, improving extension methods, and promoting institutional capacity development.

IPM Package - Project Impacts: Integrated Control Measures for Stem Borers

Stem Borers cause severe damage by boring into date palms and feeding on plant tissue – actions that lead to the injection of pathogens and broken fronds and trunks. These pests were controlled and monitored at three sites in central and southern Iraq through the use of light traps, hand collection, and cultural practices such as crop sanitation and pruning. By calculating the number of stem borer adults caught in traps, estimating population densities, and then comparing these measurements

to fields where chemical sprays were applied, researchers were able to observe the impact of IPM interventions. Results clearly indicated that integrated measures significantly reduced stem borer populations. From 2009 to 2012 the population density of larvae and adults decreased by nearly 90.5%. These interventions also had a positive impact on yields, which increased by 31% over the same period.



Stem borers cause severe damage by boring into date palms and feeding on plant tissue

Integrated Control Methods for Lesser Date Moth

Lesser Date Moths also cause severe injury to date palm: fruit becomes dry, stiff, and develops an unpleasant dark red color. Feeding can also cause fruit to drop to the ground, resulting in a significant drop in yield. In a bid to reverse these losses, the biological agent *Bacillus thuringiensis* (BT) was applied as a spray directly after pollination at demonstration sites in eight governorates. Initial infestation levels of Lesser Date Moth were estimated through the use of light traps and observing random samples of fruit for signs of infestation.



The larvae of lesser date moths can significantly damage immature fruits

Results indicated that BT was able to reduce infestation levels to acceptable levels, ranging from 33-80% after two weeks of treatment, and 38-78% after one month, depending on location and a range of other factors: date of application, the height of trees, the stage of fruit maturity, and prevailing climatic conditions. Location, cultivar and time of application also determined yield increases, which ranged from 115% among Sayer cultivars in Basra to 16% in orchards planted with mixed cultivars in Najaf.

Integrated Control Measures for Dubas Bugs

Field surveys indicated that selected combinations of neem, a natural plant extract, and summer oil were the most effective defense against Dubas Bugs. Neem and neem-summer oil demonstrated efficacies of 96.6 and 96.7% respectively. Mixing summer oil with neem did not reduce efficacy – an important finding given that summer oil is more cost-effective and can reduce spraying costs by up to 50%. The effectiveness of neem against Dubas Bugs depended on its formulation, time of application, and spraying techniques. For instance, while a dose of 3 ml/l had a significant impact on Dubas eggs, lower concentrations were less effective.

Trials also introduced a new specialized ground spraying machine which improved the quality of spraying particles, as well as quantity and reach. The significant reduction in Dubas egg and nymph populations demonstrated by these trials subsequently prompted the Iraqi Ministry of Agriculture to apply neem as part of a national campaign to eradicate Dubas Bugs.

Project Impacts:

- Test, refine, and transfer on-farm integrated control measures for Stem Borers, Lesser Date Moth and Dubas Bug
- Improve rural livelihoods and empower small farmers through the promotion of sustainable agricultural production systems
- Develop enabling policies, institutional options, and mechanisms to support the effective adoption of IPM interventions
- Build the capacities of national extension and research staff and institutions.

The Economic Benefits of IPM

The project also examined the economic feasibility of IPM, considering the costs and benefits of this approach compared to no treatment or the application of chemical pesticides. Although the use of neem with summer oil incurred additional

costs of 23 USD per 2500 m², the higher yields generated by this approach produced net benefits of 844 USD per 2500 m² compared to no treatment – a rate of return that was 37 times higher than the costs associated with shifting to IPM. Similarly, compared to the application of chemical pesticides, the higher yields and cost savings associated with IPM produced a net benefit of 403 USD per 2500 m².

Economists also calculated the income increases that farmers could expect if they used natural plant extracts to manage Dubas Bug outbreaks – as opposed to chemical control methods. Applying different selling prices for date palm, farmers could potentially earn an increment of 37.6 million USD if the selling price were 600 thousand Dinars/ton, 30.8 million USD if the selling price were 500 thousand Dinars/ton, and 28.6 million USD if the price were 450 thousand Dinars/ton. When compared to ‘no control’ methods, the corresponding figures were even higher: 75 million USD when the selling price equaled 600,000 Dinars, 62 million USD when it equaled 500 thousand Dinars/ton, and 55.5 million USD when the price equaled 450 thousand Dinars/ton.

Creating an Enabling Environment

Extending IPM interventions and maximizing impacts requires an appropriate enabling environment. Unfortunately, the absence of clear policies to support the implementation of integrated control methods makes extension in Iraq difficult. Furthermore, the use of chemical pesticides persists because these inputs receive direct and indirect support in the form of subsidies. To support the implementation of IPM, therefore, the initiative also identifies and promotes appropriate policies and institutional reforms.

The reduction of subsidies for example, which would increase the price of chemical pesticides and make these harmful and unsustainable inputs less attractive. Any public money saved could instead be used to subsidize materials required for alternative and more sustainable control methods. Changing the behavior of farmers is also dependent on improved extension, shifting from top-down to participatory approaches, such as farmer field schools, which enable farmers to more effectively judge the viability, profitability, and sustainability of IPM approaches.

In addition, project leaders encourage the development of awareness raising activities that clearly articulate the benefits of IPM to relevant audiences. A further requirement is financial commitment, providing sufficient funding that can support institutional development so that new legislation can be effectively implemented in rural areas.



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