

Effect of different levels of nitrogenous fertilization on the extent of leaf damage by leaf folder, *Cnaphalocrocis medinalis* in rice genotypes

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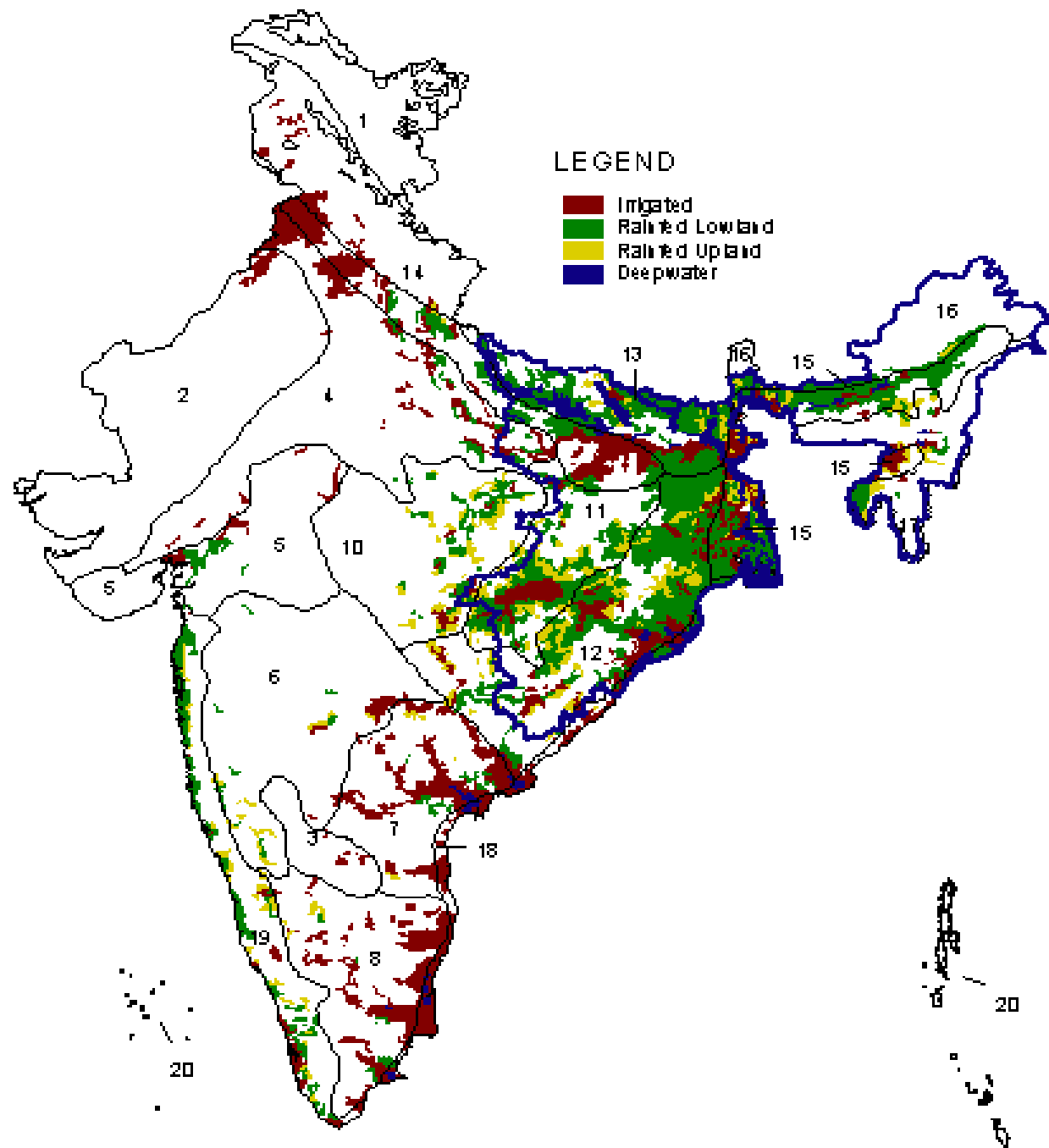
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Rice for Prosperity

- ❑ India is the second largest rice producing country in the world
- ❑ Grown 44 m ha in 534 districts covering 29 states and 7 union territories
- ❑ Grown in varied ecologies from irrigated to upland, rainfed lowland, deep water and tidal wetland ecologies.
- ❑ Predominantly grown in the eastern India covering the states like Bihar, Odisha, West Bengal, Jharkhand and eastern Uttar Pradesh.
- ❑ It is the staple food for > 70% Indians and it holds the key for food security.
- ❑ It is a source of livelihood for millions of farm families >50 million households.

Rice in India: 44 M ha

- Eastern India: 25.05 M ha
- Irrigated: 4.42 M ha
- Lowland: 14.74 M ha
- Upland: 4.17 M ha
- Very deep: 1.72 M ha



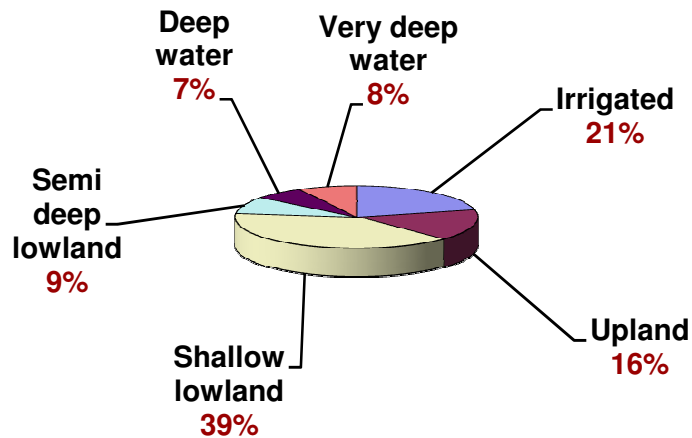
RICE AGRO-ECOLOGICAL ZONES OF INDIA

Eastern India

Rice area: 25.05 m ha

Rainfed lowlands: 14.7 m ha.
(55.0%)

Rice area (%) under different ecosystems in Eastern India



Rice Production & Export

- India moved to the top slot buoyed by record production of 105.24 million tons of rice during 2012-13 accounting for 22.81% of global production
- World's largest rice exporter beating its Asian counterpart of Thailand with the shipment of 10.4 million tons during 2013-14.
- National productivity of rice has increased from 1984 kg/ha in 2004-05 to 2372 kg/ha in 2011-12.

Crop losses

Abiotic factors

Irradiation

Water

Temperature

Nutrients

Biotic factors

Weeds

Monocots
Dicots
Parasitic
weeds

Animal
pests

Insects
Mites
Nematodes
Slugs/snails
Rodents
Birds
Mammals

Pathogens

Fungi
Bacteria
Viruses

Biotic Stresses of Rice

National Importance

- ❑ *Insects*: Leaf folder, yellow Stem Borer, BPH, WBPH, GLH, GM, gundhi bug
- ❑ *Diseases*: BLB, sheath rot, sheath blight, blast, brown spot, false smut, Rice Tungro Virus etc.
- ❑ *Nematodes*: Root knot nematode, Ufra

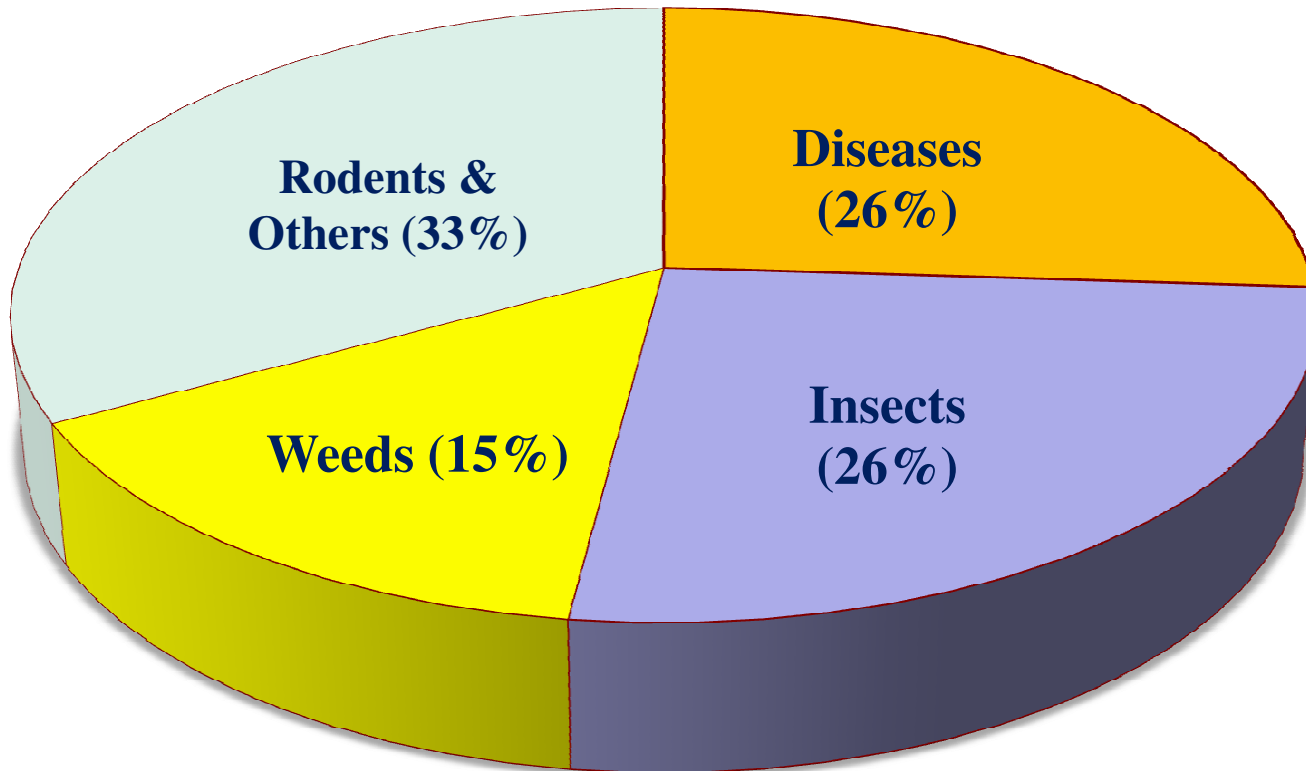
Regional Importance

- ❑ Swarming caterpillar, thrips, case worm, hispa, mites

Upcoming pests & diseases threat

- ❑ Mealy bug, mites, black bug, blue beetle

Crop Losses Due to Pests



Average 18% of the crop yield lost due to biotic stresses

Major Insect Pests of Rice



Yellow stem borer



Green leaf hoppers



Brown Plant hopper



Rice leaf folder



White backed plant hopper



Gall midge



Gundhi bug

Insect Pests in Different Rice Ecologies

S N	Rice Ecologies	Area (m ha)	Key insect pests
1	Upland	6.0	Gundhi bugs Termites, Stem borers
2	Rainfed lowland	18.0	YSB, GM, LF, Termite
3	Shallow rainfed lowland- drought prone	4.0	YSB
4	Medium deep waterlogged & flood prone (water depth : 50 - 100 cm for at least 10 days or more)	4.5	YSB, Caseworm, Hispa
5	Deepwater	4.0	YSB, Mealy bug, Hispa
6	Coastal wetland	-	YSB, LF, Caseworm

Species of Rice Leaf folder



Cnaphalocrocis medinalis



Marasmia exigua



Marasmia trapezalis



Brachmia arotraea

Cnaphalocrocis medinalis

- ❑ Earlier considered a minor pest in many Asian countries.
- ❑ Assumed major pest status since the 1980s causing severe infestation from maximum tillering to booting stage.
- ❑ The shift in pest status is mainly attributed to changes in crop management practices such as
 - ☞ Cultivation of high yielding varieties
 - ☞ Adoption of higher plant density
 - ☞ Planting either too early or too late
 - ☞ Higher N-fertilizer use
 - ☞ Increased insecticide applications affecting natural enemies

Symptoms of Damage

- Leaf margins are folded longitudinally and feed the rolled leaves by scraping chlorophyll.
- Affected leaves dry up giving seriously infected fields a scorched appearance
- In a severely infested field the whole crop gives a *sickly appearance with white patches*.
- The infestation at boot leaf stage results in *heavy loss of grain yield*
- 2-3 generations on rice crop. 1st brood on rice mainly through immigrating adults while the 2nd and 3rd broods develop within the crop and are the most damaging.

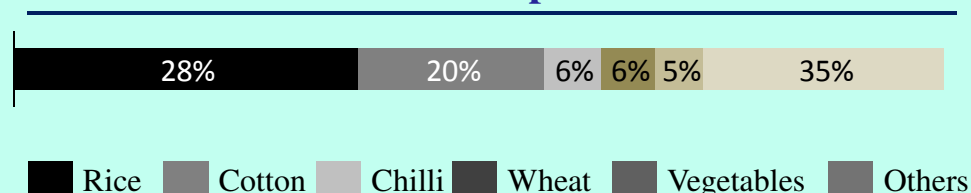


Rice Leaf folder infested Field

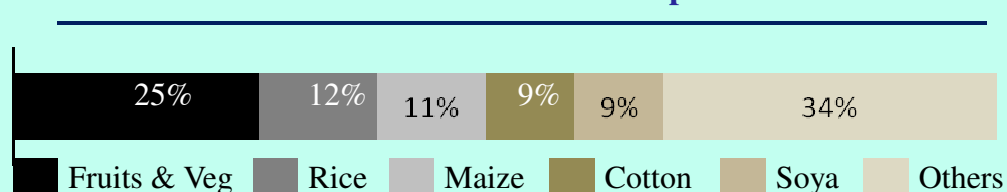
Industry Overview – Agrochemicals (Pesticides)

- ❑ **4th largest producer** in the world after the US, Japan and China.
- ❑ Produces **16% of the world's food grains**; responsible for only **2% of world's pesticides usage**.
- ❑ Approx. 18% of the crop yield worth **Rs. 900 bn is lost due to pests** every year in India.
- ❑ India's agrochemicals consumption is one of the lowest in the world with per hectare consumption of **just 0.38 Kg/ha** compared to US (4.5 Kg/ha) and Japan (11 Kg/ha).
- ❑ In India, rice accounts for the maximum share of pesticide consumption, around 28%, followed by cotton (20%).

Pesticide Consumption in India



Global Pesticide Consumption



Methodology

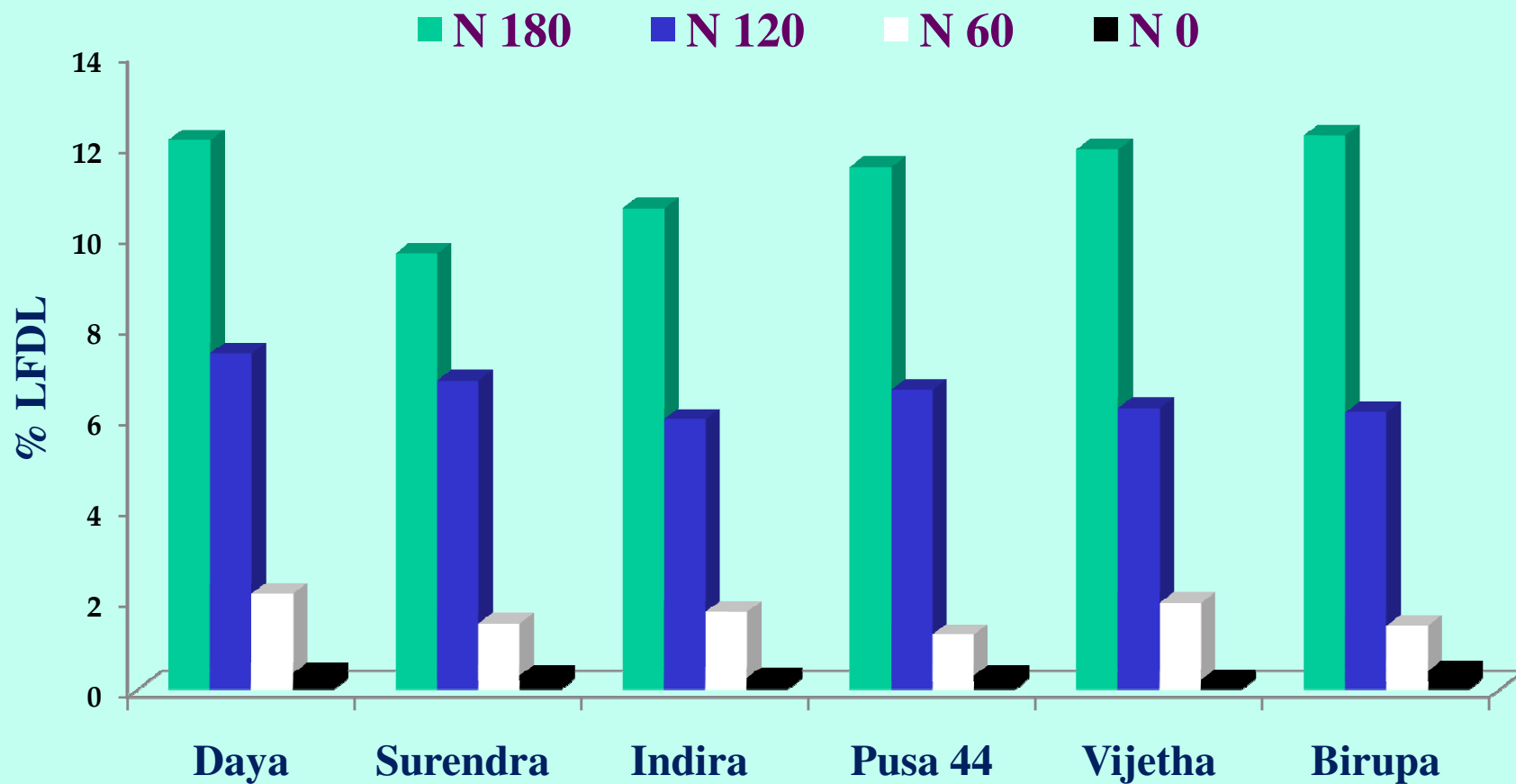
- ❑ Twenty-five derived lines of rice were evaluated against leaf folder in four nitrogen levels and compared with six popular varieties viz., Daya, Birupa, Surendra, Indira, Pusa 44 and Vijetha.
- ❑ Four nitrogen levels viz., 0, 60, 120 and 180 kg N ha⁻¹
- ❑ Observations on damaged leaves and total number of leaves were recorded and the % leaf folder damage was calculated.
- ❑ The leaves which are damaged by 2/3 portion and more were considered as damaged one.
- ❑ Biochemical analysis viz., nitrogen, phosphorus and potassium content in rice foliage.

Standard Scoring System for Leaf Folder

Scale	% leaf damage	Resistance Reaction
0	No damage	Highly resistant
1	1-10	Resistant
3	11-30	Moderately resistant
5	31-50	Moderately susceptible
7	51-75	Susceptible
9	> 75	Highly susceptible

Salient Achievements

- Significant **positive correlation** was observed between damage rating (DR) and **leaf width** and **chlorophyll content** in rice leaves
- Susceptible cv. **Jaya** retained **higher amount of N** in foliage, while the moderately resistant cv. Surendra retained **more K** and irrespective of nutrient levels.
- Increase in **N content in the foliage** showed a significant **positive correlation** with leaf folder (LF) incidence.



Effect of Nitrogen on leaf folder in rice

Promising lines against leaf folder

% leaf folder damaged leaf	Derived lines	Cross Combination
0	CR3568-1-2-1-1-1	IR 36/Lalat
< 1%	CR3516-11-1-1-3-1	Birupa /Pusa 44
	CR3510-2-1-1-1-1	IR 36/Pusa 44
	CR 3580-11-1-1-1-1	Lalat/N22
	CR3500-21-1-2-1-1	Lalat/Surendra
	CR3564-1-2-4-2-1	Vijetha /N22



Thank You All