3. Farming System

Integrated Farming System (IFS) approach considered to be the most appropriate in meeting the challenges of small-farm-agriculture and to fulfil the requirements of healthy and nutritious food, feed, fodder and other value-added commodities has been adopted. Location-specific IFS modules that not only increase system productivity, profitability and livelihood security of the farming community but also help in resource conservation and mitigating risk in agriculture and allied sectors to a large extent have been evolved.

Integrated farming systems (IFS) model for marginal farmers: An integrated farming system (IFS) model was started for marginal farmers of western Uttar Pradesh in *kharif* 2010. Of the 0.70 ha, 0.4 ha was allocated for production of cereals, pulses, oilseeds, green fodders to meet the demand of a farm family. Rest was allocated for providing nutritional security and livelihood improvement through supplementary/complementary enterprizes like horticulture (fruits/vegetables), apiary, mushroom cultivation, vermicomposting, boundary plantation along with provision for three milch animals. A net return of ₹ 100,000 was realized from 0.7 ha from the model. Recycling crop residues and farm wastes provided about 133 kg/year in terms of NPK and saved up to ₹ 4,500 on fertilizer application.

Ensuring livelihood food security and water productivity through farmers' participatory farming system approach: Promotion of kitchen gardening during monsoon in East Ganga Canal (EGC) and Agra Canal Command (ACC) resulted in vegetable production to the tune of 513 to 652 kg and 527 to 650 kg per family respectively saving up to ₹ 7,755 to 9,683 per family. Use of mineral mixture along with existing animal feed had a pronounced impact on milch animal health and enhanced milk production by 10 to 22% in Agra Canal Command and by 13 to 16% in East Ganga Canal Command area. The net annual gain due to such intervention was ₹ 9,720 to 20,088 and ₹ 5,832 to 18,144 per family per year, respectively. In a 0.2 ha fish sewage pond of Shahpur village (EGC), quality fish seedlings, mineral mixture, oilcake, rice bran and liming gave a total fish production of 2,538 kg worth ₹ 109,258.

Promotion of kitchen gardening in Ganga Canal Command

IFS model integrating fish and *singhara* with *makhana*: Integration of fish and *singhara* (*Trapa bispinosa*) with *makhana* (*Euryale ferox*) exhibited fish yield of 0.18 to 0.4 tonne/ha and *makhana* seed yield of 1.06 to 2.06 tonnes/ha and water chestnut yield of 3.08 to 8.8 tonnes/ha respectively. This resulted in net profit of ₹20,015/ha with an employment generation of 240 man-days/ha/year.

Integration of fish and *singhara* with *makhana*

Improved pointed gourd: Pointed gourd variety Swarna Suruchi, with the following characteristics, was released for commercial cultivation in Bihar and Jharkhand – Vine length 2.5 to 3 m; 70 to 80 nodes; smooth fruits, light green in colour with fruit length ranging from 8.5 to 9.0 cm with blunt ends on both sides; fruit weight 35 to 40 g; fruit breadth 3 to 3.5 cm; pulp : seed ratio 4 : 1; and yield/plant 4 to 4.5 kg.

Improved variety of pointed gourd

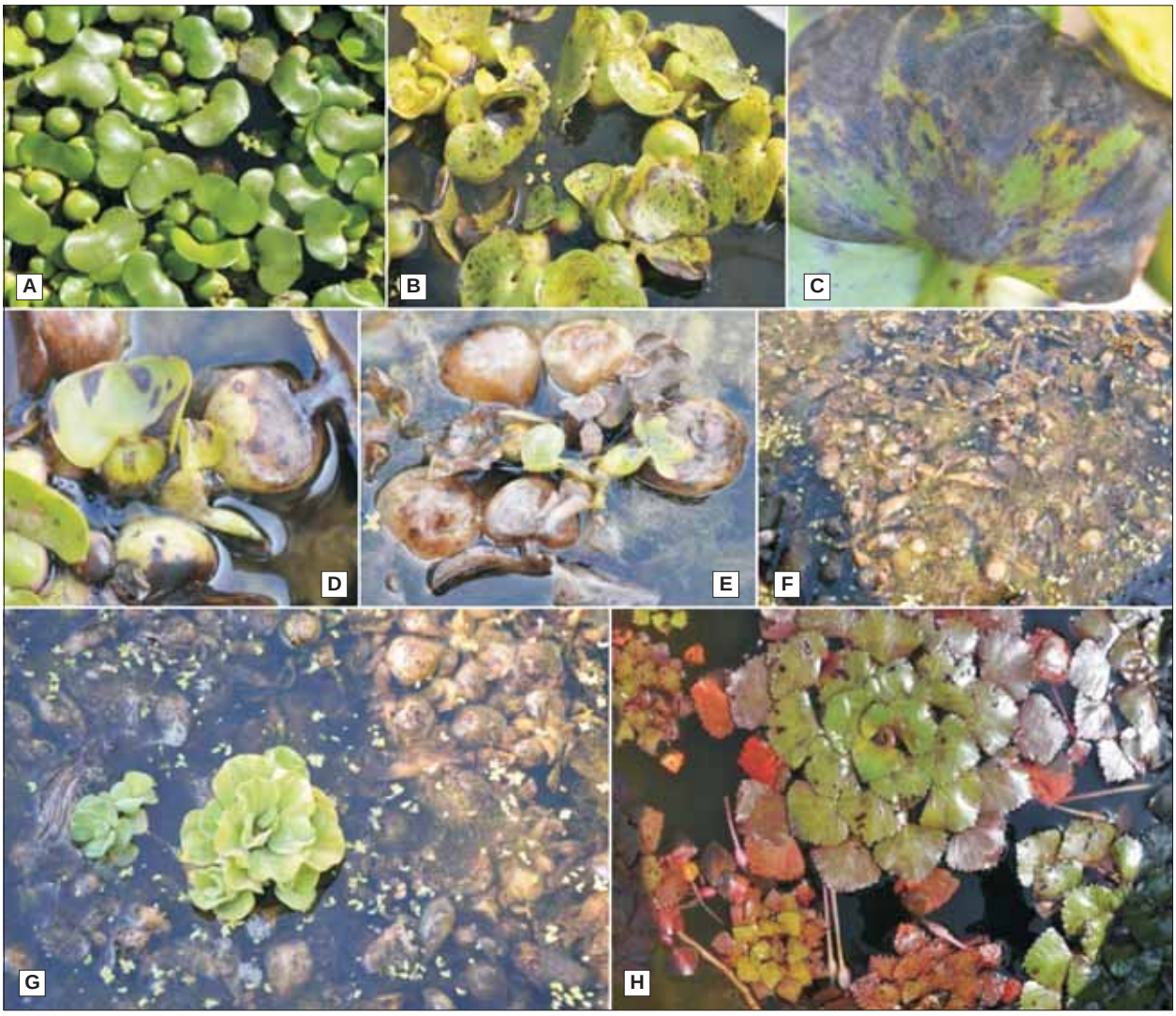
Improved *lasora* genotypes: Two elite genotypes, CAZRI-G 2021 and CAZRI-G 2025 of *lasora* or *gunda* (*Cordia dichotoma*), were selected from seedling

(A) CAZRI-G 2021; and (B) CAZRI-G 2025 are two elite genotypes of *Iasora* (*Cordia dichotoma)* and perform well in respect of fruit yield and pulp content

populations and further multiplied by budding, which performed consistently well in respect of fruit yield and pulp content. Yield potentials of 59.5 kg and 98.2 kg were recorded in CAZRI-G 2021 and CAZRI-G 2025 respectively.

Biological management of water hyacinth using antagonistic fungi and insect bioagent, *Neochetina bruchi*: Potential native antagonistic fungi, viz. *Fusarium* sp., *Curvularia lunata* and *Alternaria alternata,* were isolated from the naturally infested water hyacinth in and around Jabalpur and their pathogenicity confirmed by Koch's postulates. The fungi were applied 20 days after the inoculation of *Neochetina bruchi* weevils, a host-specific bioagent, responsible for creating injuries in the process of their feeding on the leaves of water hyacinth. The insect bioagent, facilitated and hastened the entry of the pathogen, compared to the weevil or fungi alone, causing severe disease in the second and third week after inoculation. This led to loss of floating ability and resulted in the submergence of water hyacinth. Host specificity test indicated that *A. alternata* and *A. eichhornia* did not infect other aquatic plants like *Pistia stratiotes* and *Eleocharis dulcis* (water chestnut) showing host specificity of the pathogen.

CSR 43: A new short-duration, salt-tolerant rice variety: A new variety of rice, CSR 43, was released for the sodic soils of Uttar Pradesh which can withstand sodicity up to pH ~ 9.9. This cultivar matures in 115 to 120 days, about 15 to 25 days earlier than the prevailing cultivars – Indrasan, Narendra 359 and Sambha Mahsoori – enabling to fit into the rice–wheat crop rotation with



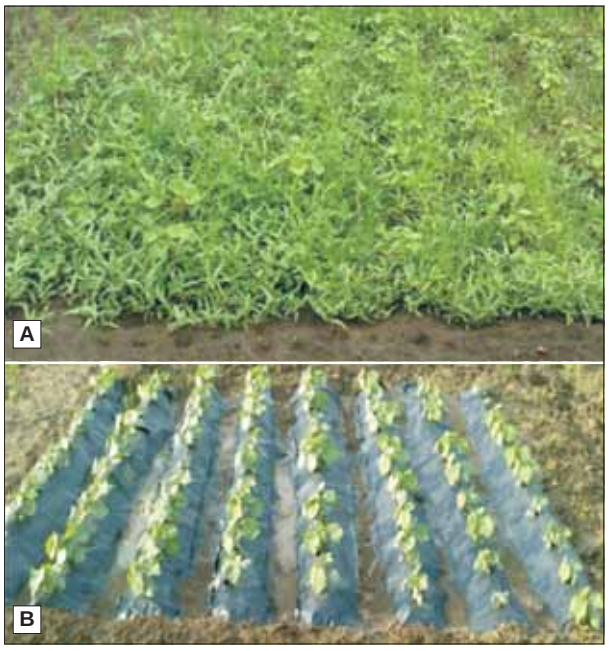
(A) Healthy water hyacinth; (B) Symptoms of *Neochetina bruchii* on water hyacinth; (C) Close-up of infection caused by weevil and fungal consortium; (D &E) Initial and advanced stages of symptoms of infection caused by the consortium of fungi and *N. bruchii*; (F) Complete submergence of diseased water hyacinth; (G & H) Both *A. alternata* and *A. eichhornia* were not pathogenic to other aquatic plants like *Pistia stratiotes* and *Eleocharis dulcis*

an yield potential of 3.5 to 4 tonnes/ha in sodic soils and saves two irrigations.

Resource-conservation technologies for rice-wheat cropping system: Experimentation for the past five years indicated that direct-seeded rice yielded at par with transplanted rice, but saved 20–25% water, 40–50% diesel, 25–30% electricity and 25–30% labour. Rice transplanted with wheat-residue incorporation and rice transplanted after green-manuring was most remunerative where irrigation water was not a constraint.

Weed management

***Kharif* okra-tomato cropping system:** In okra, major weed flora observed were: *Phyllanthus niruri, Echinochloa colona, Cyperus iria, Dinebra* sp., *Commelina benghalensis,* and *Physalis minima,* which caused yield losses of 15 to 55%. Use of black polythene mulch in okra recorded no weeds up to 60 days after sowing when integrated with farmyard manure (FYM 10 tonnes/ha) compared to control (145 no./m^2). This treatment recorded the highest pod yield of okra (15.07 tonnes/ha) compared to control (5.59 tonnes/ha). In case of tomato, major weeds consisting of *Medicago denticulata, Cichorium intybus, Physalis minima, Chenopodium album, Paspaladium* sp. and *Vicia sativa* caused 42 to 70% loss in fruit yield. Use of black polythene mulch along with FYM (10 tonnes/ha) resulted in lowest weed density at 60 days after sowing and highest tomato yield of 23.87 tonnes/ha, which was at a par with the treatment receiving 50% FYM + 50% NPK+ herbicide followed by one manual weeding 45 days after sowing (22.7 tonnes/ha) compared with the control (2.6 tonnes/ha).



(A) Unweeded okra; (B) crop using black polythene mulch + 10 tonnes/ha FYM

Fish

Farming of pompano—A marine fish in coastal ponds: The CMFRI successfully conducted maiden harvest of newly bred fish, silver pompano, *Trachinotus blochii* (American pomfret) at Antervedi Fish Farm, East Godavari, Andhra Pradesh. About 3,600 seed were stocked in one acre pond of a farmer, fed with indigenously formulated pellet feed costing about ₹125/kg. After 8 months of rearing with a survival of more than 95% and an FCR of 1 : 1.8, crop reached a size range of 450–550 g weight, an excellent table size for marketing. The fish tolerated wide salinity range from 5 to 35 ppt and can feed at all angles, which makes it a versatile and most aquaculture friendly species. By separating the nursery phase it is possible to have two harvests in one year. About 12,000 seeds can be stocked in 1 ha and about 5 tonnes of fish can be harvested for each crop. Silver pompano fetches a farm gate price of about ₹ 200/kg. In the domestic market, silver pompano has demand starting from 250 g size onwards. Hence, it is felt that pompano aquaculture can emerge as a major aquaculture enterprise in the coming years.

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