

PRODUCTIVITY IMPROVEMENT

Population boom and encroachment of farm land by other sectors of economy necessitates that research is focused on productivity improvement on a long term basis. Productivity improvement underpins profitability and better wages. Productivity improvement research focuses on cropping patterns and management practices that enhance production and farmers' income without increasing inputs. Further biological innovations should emphasize the direction and efficiency of production and sources of improvement.

PLANT SCIENCES

Wheat

Agriculture Production Modeling Studies

- Agriculture Production Simulator (APSIM) is a modeling framework that has the ability to integrate models derived in fragmented research efforts. This enables research from one discipline or domain to be transported to the benefit of some other discipline or domain. It also facilitates comparison of models or sub-models on a common platform. APSIM was tested and modified for adoption in local environment.

Fertilizer Split dosage studies

- Wheat yield improved by splitting nitrogen dose in high rainfall area as a result of study which indicated that 30% higher grain yields were obtained when 1/3rd nitrogen was applied at planting and remaining 2/3rd at first node stage (5.5 t/ha) in comparison with single planting dose (4.2 t/ha).

Drought and Heat Stress Investigations

- Five varieties of wheat namely Chakwal-97, Inqalab-91, Margala-99, NR-234 and Wafaq-2001 were exposed to drought at primordia, mid-milky and dough stages of grain development. Significant reduction in grain yield was observed in all the test varieties when drought was imposed at mid-milky stage.
- Six varieties of wheat namely Chakwal-97, Inqalab-91, Margala-99, NR-234 Wafaq-2001 and SH-2002 were subjected to heat stress in growth chamber at mid-milky stage between 11 and 15 hours for 3 consecutive days. Heat stress reduced the grain yield by 56 to 78%.

Rice

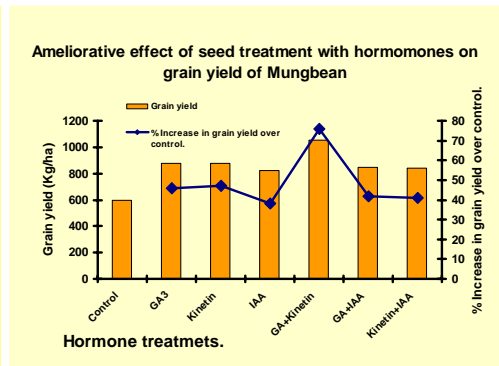
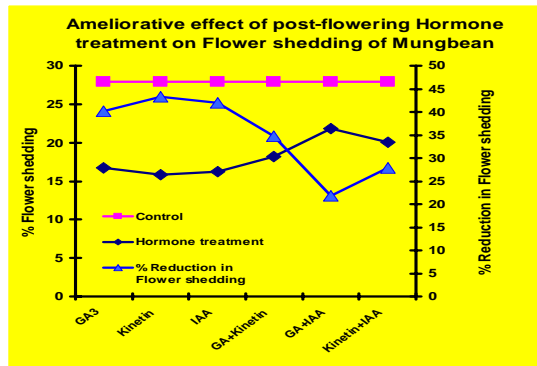
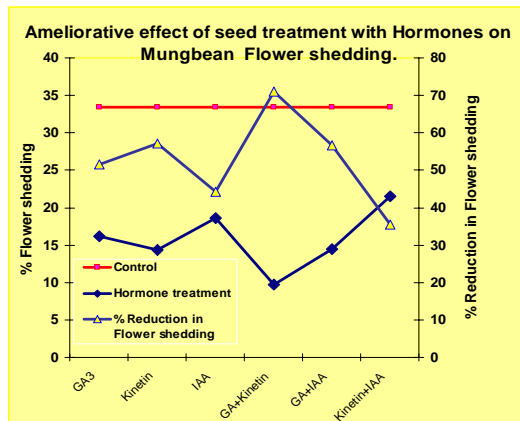
Production packages were investigated in direct seeded, bed and zero tillage practices:

- High weed density was recorded in direct seeded rice followed by transplanting on beds and double zero tillage. Infestation and population of insect pests was very low except leaf folder.
- The highest incidence (23.7%) of leaf folder was recorded in direct seeded crop and the lowest was in conventional planting. The highest grain numbers were in conventional planting, followed by double zero tillage and bed planting. Highest paddy yield was obtained in zero tillage (4.8 t/ha) followed by conventional method (4.7 t/ha), transplanting on beds (4.4 t/ha) and direct seeding (3.6 t/ha)
- Weeds population was lowest when ethoxysulfuron + phenoxaprop-p-ethyl were applied 35 days after seeding to control weeds in direct seeded rice.

Pulses

Flower Shedding in Mungbean

The result of a study to ameliorate effects of hormones towards controlling flower shedding in mungbean (physiological disorder) showed that all the hormone treatments (seed pre-treatment, pre-flowering spray & post-flowering spray) decreased shedding %age of mungbean flowers. Decrease in flower shedding was more in hormone seed pre-treatment and pre-flowering spray (9.7% & 10 %) as compared to control (33.4%). Hormones GA & Kinetin alone or in combination decreased more flower shedding in the seed pre-treatment & pre-flowering spray. All the hormone treatments (seed pre-treatment, pre-flowering spray & post-flowering spray) increased grain yield as compared to control. Combination of hormone GA + Kinetin was found the best in the seed pre-treatment & pre-flowering spray.



Nodulation capability trials

Nodulation capability trials on chickpea, lentil and mung bean showed that *Rhizobium* inoculated seeds produced plants with higher number of nodules and nodule weight. In chickpea genotypic difference were evident for nodule number and nodule dry weight. Chickpea cultivars NCS-950204 and NCS-9917 out performed others in these traits.

Sugar Crops

Production Package Investigations

- Study on the effect of number of sets/buds per ha conducted to determine the suitable number of sets/buds for maximum cane yield, revealed that the sugarcane planting at seed

rate of 75,000 double budded sets (DBS) per ha resulted in maximum number of mill-able canes (135 thousand canes per ha) and cane yield of 170 tons/ha.

- Field experiments were conducted in Sargodha and Jhang districts to determine nutritional need of sugarcane during 2005-06. Application of pressmud at 10t ha⁻¹ along with Zn (7.5kg ha⁻¹) + B (1.5kg h⁻¹) and 50% of recommended rate of NP and K fertilizer gave better cane yield, brix (total soluble solids) and number of canes per hectare and also maximum net benefit. The increase in yield was 22.8% over that of farmers practice.
- Sugarcane variety Thatta-10 gave maximum cane yield of 117.93 t/ha and CCS of 12.92% when it was planted at 1.25 m row spacing with double seed placement technique. In the ratoon trial similar response of Thatta-10 for cane yield and quality was observed with same treatments.

Fruits and Vegetables

- Commercial economic life of peach orchards is short due to toxins exuded in the soil by roots of plants budded on local peach rootstock. Peach rootstock GF-677 proved better than local rootstock, especially for alkaline soils. It was vigorous, did not produce suckers and was resistant to peach rust, crown gall and root knot.
- Onion set size of 21 mm diameter produced the highest marketable yield (26.57 t/ha) for autumn crop.
- Radish seed vernalization for 8 days at 5°C resulted in early maturity of crop with higher seed yield.
- Okra variety Sabz Pari produced maximum fruit yield (23.27 t/ha) with the plant population of 125000 plants/ha.
- Tomato variety Roma with rice straw mulch produced maximum marketable fruit yield (44.83 t/ha) as compared to control (31.10 t/ha).
- Cucumber hybrid produced maximum fruit yield (5.87 kg/m²) when all lateral branches were pruned and only single stem was retained under plastic tunnel.

Potato

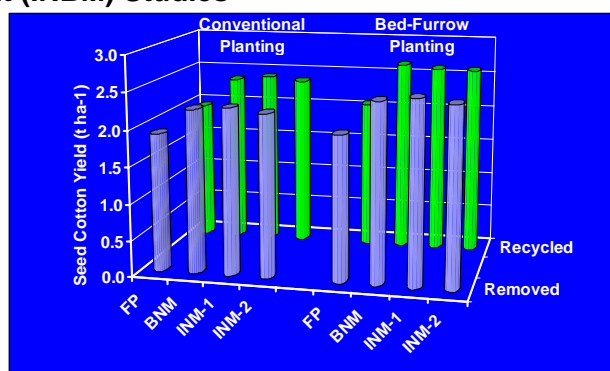
- Foliar application of K super-imposition enhanced potato tuber yield. The TPS families 9813 (24.05 t/ha) and 9802 (22.72 t/ha) produced higher yield as compared to control variety Diamant (17.5 t/ha).

Tea

- Six elite tea bushes were selected, which gave 7-8 kg of fresh harvest per bush/annum. Treatment with 1000-5000 ppm IBA in sand media resulted in 99.7% survival rate and 5.56 roots/plant in a broad leaved tea variety whereas in narrow leaved tea variety 61.13% survival rate and 5.56 roots/plant were observed.
- Out of five growing environments maximum survival 85.0%, germination 96.0%, plant height 39.0 cm and number of leaves/plant 16.0 were recorded in tea seedlings under nylon net + transparent plastic sheet.
- Round up applied @ 1500 ml/ha followed by Gramaxone applied @ 2000 ml/ha effectively controlled the weeds in 3 year old tea garden.

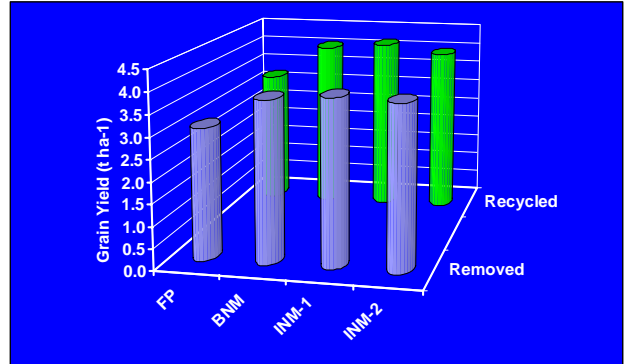
Integrated and Balanced Nutrient Management (INBM) Studies

Integrated Nutrient Management (INM) involves combination of organic and inorganic fertilizers to meet the plant requirements whereas Balanced Nutrient Management (BNM) provides inorganic fertilizer to the plant



in the required amounts. Using a combination of two improved fertilizer efficiencies have been achieved.

- Seed cotton yield increase was 23–40% over farmers' practice under BNM approach in four different soil series. The INM improved the fertilizer efficiency further by about 2% in case of phosphorus and 5% in case of nitrogen.
- Wheat grain yield increase was 19–39% under BNM approach in four different soil series. The INM further improved fertilizer efficiency by 2% in case of phosphorus and 5% in case of nitrogen.



Small Ruminants

- By mineral supplementation, the productivity of Dera Din Panah goat was improved in terms of fertility rate and survival rate.
- Balkhi sheep has potential for mutton production. Average adult ewe body weight was 54.3 kg with a fertility rate of 82% and twinning 6%. Mean birth weights of lambs were 4.8 and 4.5 kg for males and females, respectively. Mean weaning weights were 33.8 and 27.0 kg in males and females, respectively. The average pre-weaning daily weight gain was 242 and 187 g/d in males and females, respectively. The hogget weight was 48 and 44.8 kg in males and females, respectively with an average daily gain of 144 and 134 g/d in males and females, respectively. Under natural grazing conditions.



Balkhi sheep breed being studied for its traits of economic importance at NARC