DETAILS OF NEW TECHNOLOGIES RECOMMENDED FOR INCLUSION IN PACKAGE OF PRACTICES (26)

Crop Production (13)

Agronomy (11)

- **Climatic normals for different phenophase in finger millet:** Tillering stage is characterized by moderate precipitation (147-162 mm), optimal thermal conditions (Tmax 26-28℃; Tmin 18-20 ℃), and high atmospheric humidity (RHI 87–93%; RHII 54-66%), which collectively enhance vegetative proliferation and canopy establishment. During the active growth phase, the crop exhibits maximum moisture demand (228-235 mm rainfall) under similar temperature and humidity regimes, reflecting the requirement for adequate soil moisture availability to sustain rapid biomass accumulation and physiological activity. Ear head development occurs under moderately reduced precipitation (68-89 mm), stable warm temperatures (25-28 ℃), and sustained higher humidity, conditions conducive to reproductive differentiation and spikelet formation. Physiological maturity is associated with minimal rainfall (10-21 mm), relatively lower nocturnal temperatures (15-19 ℃), and increased solar radiation (5–9 sunshine hours), which facilitate grain desiccation, dry matter stabilization and harvest quality. The results clearly demonstrate that each crop requires distinct stage-specific climatic requirements.
- **Climatic normals for different phenophase in groundnut:** Early vegetative development (30 days after sowing) requires substantial moisture (123-139 mm rainfall), warm temperatures (Tmax 27-28 ℃; Tmin 19-20 ℃), and higher relative humidity (RHI 91-94%), which support leaf area expansion and root establishment. The 50% flowering phase occurs under moderate precipitation (~64 mm) and a relatively broader thermal range (26.6-29.5 ℃), indicating tolerance to slight temperature variability during reproductive initiation. Peg initiation is strongly dependent on adequate soil moisture (~109 mm rainfall) and stable warm conditions, which are essential for successful gynophore penetration and pod set. Pod filling requires comparatively higher moisture availability (~137 mm rainfall) combined with moderate humidity and increased sunshine, facilitating assimilate translocation and kernel development. Physiological maturity occurs under reduced precipitation (~89 mm), cooler minimum temperatures (16.5-18.1℃), and increased solar exposure, promoting pod drying and physiological stabilization.
- **Climatic normals for different phenophase in pigeonpea:** Primary branch initiation is supported by moderate rainfall (99-134 mm), warm temperatures (Tmax 27–29 ℃; Tmin 19–20 ℃), and higher morning atmospheric humidity (RHI 90–94%), conditions

favourable for vegetative differentiation and structural development. Flower bud initiation represents the phase of highest moisture requirement (335-360 mm rainfall) under sustained warm and humid conditions, indicating strong sensitivity of reproductive onset to moisture availability. Grain filling proceeds under moderate precipitation (77-92 mm), stable thermal conditions, and persistently high humidity, which collectively enhance seed development and assimilate accumulation. Physiological maturity is associated with comparatively lower rainfall (71-130 mm), slightly reduced minimum temperatures (16-19 °C), and increased sunshine duration, facilitating seed desiccation and attainment of harvest maturity.

- **Weed management in soybean:** Application of pre-emergence herbicide, Sulfentrazone 28% + clomazone 30% WP @ 725g/ha recoded lower weed density of 8.64 No/m^2, 20.65 No/m^2 and 27.72 No/m^2 at 15, 30 and 45 DAS respectively with higher yield (1410 kg/ha), net returns (Rs. 61,668 /ha) and B:C ratio (2.22). While application of post emergence herbicide Sodium acifluorfen 16.5% + Clodinafop propargyl 8% EC @ 245 g a.i/ ha recorded lower weed density of 29.65 No/m^2, 11.61 No/m^2 and 19.99 No/m^2 at 15, 30 and 45 DAS respectively with higher yield (1450 kg/ha), net returns (Rs. 55698 /ha) and B:C ratio (2.36) as that of hand weeding twice at 20 and 40 DAS recorded lowest weed density of 9.82 No/m^2 (30 DAS) and 9.90 No/m^2 (60 DAS) with higher yield (1490 kg/ha), net returns (Rs. 61,810 /ha) and B:C ratio (2.11).
- **Evaluation of pre and post emergence herbicide in field bean:** Application of pre – emergent herbicide, Diclosulum 84% WDG at 26 g a.i/ha recorded the lowest density and dry weight of 21.62 No/m^2 and 2.88 g/m^2 at 40 DAS respectively and 27.09 No/m^2 and 3.31 g/m^2 at 60 DAS respectively. With respect to yield and monetary returns, recorded the highest seed yield (0.83t/ha) and B:C (2.49). Application of post – emergent herbicide imazethapyr 10SL + surfactant 75 g a.i/ha recorded lower weed density of 13.98 and 17.22 No/m^2 at 40 and 60DAS respectively and lowest weed dry weight of 1.84 g/m^2 at 40 DAS and 2.06 g/m^2 at 60 DAS with highest seed yield of 0.81t/ha and B:C (2.38).
- **Management of Itchgrass, *Rottboellia cochinchinensis* an invasive weed in maize:** Application of Pendimethalin 38.7% CS as pre-plant incorporation (PPI) @ 700 ml/acre followed by Pendimethalin 38.7% CS as pre-emergence @ 700 ml/acre, or application of Tolpyralate 40% SC @ 50 ml/acre at the 2–3 leaf stage of the weed, effectively managed the invasive itch grass, recording 95–98% weed control efficiency. This technology provides an effective solution for controlling this troublesome weed, which can cause 50–100% yield loss in maize and by recommending the above herbicides, it effectively controls the itch grass and other weeds.
- **Development of rainfed Integrated Farming System modules for marginal and small farm holdings:** Inclusion of diversified enterprises and natural resource management

(NRM) modules in IFS models significantly enhanced system productivity, profitability, and employment generation over conventional farming systems. Under rainfed conditions, the developed IFS model recorded system productivity of 8257 kg/farming system, net returns of ₹1,81,996/farming system, and 358 man-days for marginal farmers, and 11,126 kg/farming system, ₹2,30,435/farming system, and 423 man-days for small farmers, compared to 5866 kg and 6310 kg/farming system, ₹1,10,689 and ₹1,35,660/farming system, and 316 and 341 man-days, respectively, under conventional systems. Under partially irrigated conditions, the IFS model recorded higher system productivity (10,959 kg and 15,245 kg/farming system), net returns (₹3,47,888 and ₹4,40,161/farming **system**), and employment generation (395 and 470 man-days) for marginal and small farmers, respectively. Integrated farming approach proved economically viable and sustainable by improving profitability, livelihood security, employment generation, and system resilience in rainfed agro-ecosystems.

- **Evaluation of suitable crops and compartment bunding for in-situ moisture conservation during pre-monsoon season:** Formation of rectangular compartment bunds (3 m × 2.8 m) was found superior to duck foot cultivation and conventional tillage, recording a higher grain yield of 894 kg/ha, rainwater use efficiency of 2.58 kg/ha-mm, net returns of ₹52,512/ha, and a B:C ratio of 2.80. Among the crops evaluated, field bean was the most suitable for this moisture conservation practice, recording the highest grain yield (1099 kg/ha) and RWUE (2.78 kg/ha-mm), followed by green gram (923 kg/ha and 2.69 kg/ha-mm, respectively), indicating that compartment bunding is an effective strategy for enhancing resource-use efficiency and crop productivity during the pre-monsoon season.
- **Sensor-based water management in maize:** Adoption of Yellow colour Soil Moisture indicator-based drip irrigation at 15 cm soil depth resulted in 30.29% water saving, along with a 14.16% increase in grain yield (96.96 q/ha) and a B:C ratio of 2.98 compared to the conventional irrigation practice.
- **Sensor-based water management in baby corn:** Adoption of Yellow colour Soil Moisture indicator-based drip irrigation at 15 cm soil resulted in 17.27% water saving, along with a 6.59% increase in baby corn yield (109.48 q/ha) and a B:C ratio of 2.22 compared to the conventional irrigation practice.
- **Evaluation of foliar application of water-soluble fertilizer in finger millet:** Foliar application of water-soluble fertilizer (19:19:19) improved crop growth and productivity, resulting in a higher grain yield of 2479 kg/ha and fodder yield of 5687 kg/ha compared to the application of recommended dose of fertilizers (2191 kg/ha and 5109 kg/ha, respectively). This technology increased grain yield by 13.14%, fodder yield by 11.31%, and recorded higher B:C ratio of 2.24.

Soil Science & Agricultural Chemistry (1)

- **Application of liquid microbial mixture for enhancing the quality and yield of mulberry:** Application of RDF (140:56:56 $N_2O_{52}O$ kg/ha/year) with FYM @ 10 t/ha/year and liquid biofertilizer consortium (3 l/ha) at 8 and 25 days after pruning enhances mulberry leaf yield (621.5 q/ha/year), leaf quality, soil health and B:C ratio (3.58) over the application of RDF (leaf yield: 511 q/ha/year and B:C ratio: 2.60) .

Sericulture (1)

- **Use of diatomaceous earth and silicic acid in mulberry:** Application of diatomaceous earth @ 450 kg/ha in five split doses (@ 36 kg/ac/crop) along with inorganic fertilizers and spraying silicic acid @ 0.4% (4 ml/l of water) 28 days after pruning enhanced cocoon production to 81.6 kg/100 DFLs with a 6.05% increase and higher B:C ratio of 3.46 over the application of recommended dose of fertilizers (3.03), representing a 14.05% improvement in profitability.

Crop Protection (5)

Pathology (3)

- **Management of *Turcicum* leaf blight in maize:** Spraying Azoxystrobin 18.2% + Cyproconazole 7.3% SC @ 1 ml/litre of water resulting in a higher yield (54.25 q/ha) and B:C ratio (2.03) over the existing recommendation of Azoxystrobin 18.2% + Difenoconazole 11.4% SC @ 1 ml/litre of water (45.63 q/ha and 1.62, respectively). The proposed technology increased yield by **20.3%**, effectively managed Turcicum leaf blight, improved produce quality, and also controlled downy mildew disease. If necessary, repeat the second spray after 30 days.
- **Management of fusarium wilt in pigeonpea:** Seed treatment with Carboxin 37.5% + Thiram 37.5% WS @ 4 g/kg seed effectively reduces wilt and root rot diseases and resulting in higher yield (1037.33 kg/ha) and B:C ratio (1.97) over the existing recommendation of Carbendazim 12% + Mancozeb 63% WP @ 3 g/kg seed (928.33 kg/ha and 1.87, respectively).
- **Management of the leaf spot disease in banana:** Spraying Pyraclostrobin (133 g/L) + Epoxiconazole (50 g/L) @ 2 ml per litre of water effectively reduces disease severity, recording the lowest PDI of 17.5, and produces the highest yield of 14.19 t/ha with an ICBR of 2.83 or Spraying Tebuconazole (50%) + Trifloxystrobin (25%) WG @ 0.5 g per litre of water records PDI of 20.5, yields 13.59 t/ha, and provides an ICBR of 2.53. Both fungicidal treatments are effective and economically profitable for disease management and yield enhancement. repeat the spray after 15 days.

Entomology (1)

- **Management of gram pod borer *Helicoverpa armigera* and spotted pod borer *Maruca vitrata in* pigeon pea:** Application of Fluxametamide 10% EC and Broflanilide

30% SC effectively reduced the pod borer populations by 60.64% and 76.70%, spotted pod borer populations by 70.52% and 73.84%, pod damage by 34.66% and 45.51%, increased grain yield by 33.01% and 38.01% and recorded B:C ratios of 3.50 and 3.61, respectively. These novel green molecule insecticides, characterized with a unique GABA-gated chloride channel mode of action, are comparatively safer to natural enemies and provide an effective option for insecticide resistance management.

Apiculture (1)

- **Management of Small Hive Beetle in honey bee colonies:** Regular inspection of honey bee colonies with strict sanitation practices viz., destruction of beetles, grubs, infested combs and hive debris through burning are essential for managing the small hive beetle, *Aethina tumida* Murray. Avoid transferring equipment from infested colonies to healthy apiaries and do not leave empty combs in super chambers, as they serve as beetle refuges. Installation of plastic case traps baited with a mixture of pollen, honey and yeast (10:10:1) fortified with Chlorantraniliprole 18.5% SC @ 0.5 ml/kg or Thymol @ 10 ml/kg or ajwain oil @ 10 ml/kg effectively attracts and suppresses beetle populations. Placement of these baited traps inside the hive resulted in annual honey yields of 8–10 kg per colony and recorded a cost–benefit ratio of 1:1.24 compared to untreated colonies.

Agril. Engineering (8)

- **Universal pulses pods sheller (both fresh & dry pods):** The Universal Pulses Pods Sheller is designed to extract fresh beans and peas from green pulse crops such as field bean, peas, cowpea, red gram, and other legumes, and can also be used for shelling dry pods. It is a semi-automatic machine powered by a 0.5 hp single-phase electric motor, with a throughput capacity of 50–60 kg/h, shelling efficiency of more than 95%, and output capacity of 25–30 kg/h. The machine is compact, lightweight, women-friendly, easy to transport, and highly suitable for commercial applications. It is recommended for small and medium farmers, KVKs, SHGs, FPOs, cottage industries, restaurants, retail outlets, hotels, and custom hiring centres. Its use reduces drudgery, saves time, increases income, and minimizes post-harvest losses.
- **Maize sheller (for variable-sized cobs):** The Maize Sheller is primarily used for extracting grains from maize cobs of varying sizes. It is a semi-automatic machine with manual feeding and is operated using a 1 hp single-phase electric motor. The machine has a shelling capacity of 1,125–1,565 cobs per hour with an efficiency exceeding 98%. It delivers a seed output of 152–211 kg/h for normal maize with less than 3% seed damage. The machine is suitable for farmers, seed-processing units, poultry enterprises, and small-scale corn starch extraction units.
- **Double head maize/sweet corn seeds sheller:** The Double Head Maize/Sweet Corn Seeds Sheller is specially designed for extracting sweet corn seeds from cobs and can also

be used for shelling other maize varieties with appropriate adjustments. It is a semi-automatic machine equipped with dual shelling units and powered by a 0.5 hp single-phase electric motor. The machine has a throughput capacity of 592–618 cobs per hour with shelling efficiency greater than 99%. It provides a seed output of 56–60 kg/h for sweet corn and about 110 kg/h for normal maize, with negligible seed damage (<1%) and seed germination of approximately 95%. It is suitable for farmers, seed-processing units, poultry farms, and corn starch extraction units.

- **Castor decorticator:** The Castor Decorticator is used to remove the hard outer shells from well-dried castor capsules and extract castor seeds. It is a semi-automatic machine operated by a 0.5 hp single-phase electric motor. The machine has a throughput capacity of 90–100 kg/h, a decortication efficiency of 98%, and a seed output capacity of 60–70 kg/h. It is suitable for small and medium farmers, agro-processing units, non-edible oil extraction industries, small-scale lubricant manufacturers, and custom hiring centres.
- **Sunflower thresher-cum-sunflower seed dehuller:** The Sunflower Thresher-cum-Sunflower Seed Dehuller is used for removing seeds from sunflower heads and dehulling graded sunflower seeds to obtain kernels for confectionery and edible oil purposes. It is a semi-automatic machine powered by a 1 hp single-phase electric motor. The threshing efficiency is 99% with a capacity of 250 heads per hour, producing 18–20 kg/h of seed output depending on seed size. The dehulling unit has a throughput capacity of 15–18 kg/h with an efficiency exceeding 95%, kernel recovery of 80–85%, and broken kernels ranging from 4–7%. The machine is suitable for cottage-scale agro-processing units, self-help groups, and bakery or confectionery industries.
- **High capacity tamarind dehuller:** The High Capacity Tamarind Dehuller is designed for efficient separation of hulls from well-dried tamarind pods. It is a double-stage machine powered by a 3 hp single-phase electric motor and has a low operating cost of approximately ₹110 per tonne of pods processed. The machine offers a throughput capacity of 500–1,000 kg/h with an efficiency greater than 95%. It is suitable for marginal and large farmers, agro-processing units, and custom hiring centres.
- **Tamarind de-seeder:** The Tamarind De-seeder is used to remove seeds from well-dried, dehulled, and defibered tamarind pods and to obtain raw tamarind pulp (Grade-II) for commercial use. Prior removal of hulls and fibres followed by drying and cooling of the pods is essential before deseeding. The machine is powered by a 2 hp single-phase electric motor and has a throughput capacity of 100 kg/h with an efficiency of 90%. It is suitable for farmers of all categories, commercial tamarind pulp production units, self-help groups, agro-processing units, and custom hiring centres.
- **Hot air popping machine:** The Hot Air Popping Machine is used for popping millets and other grains such as finger millet, kodo millet, grain amaranthus, quinoa, corn,

sorghum, pearl millet, and sabbakki. It is an electrically operated single-phase machine that can be easily handled by unskilled operators. Popping is carried out in a fluidized state using hot air at optimized temperatures. The machine achieves a popping efficiency of 90%, provides approximately two-fold volumetric expansion of millet pops, and produces a popping yield of more than 85%, which is about 1.8 times higher than conventional methods. It is highly suitable for women self-help groups engaged in the production of value-added millet-based products.