

NEW TECHNOLOGIES RECOMMENDED FOR INCLUSION IN PACKAGE OF PRACTICES

A total of **26** new technologies on various crops on different aspects have been recommended for inclusion in the package of practices in different zones.

Crop Production (18)

Agronomy (13)

- **Integrated farming systems:** Sixty integrated farming systems models that are specific for irrigated, rainfed and semi-irrigated conditions suitable for one hectare and one acre of land in the 10 districts under the jurisdiction of the University of Agriculture, Bangalore have been developed. Adopting Integrated farming systems enhances livelihood and economic sustainability (farmers can earn Rs. 4.36 as profit for every rupee invested) by balancing the agricultural / horticultural crop yield loss due to aberrant weather situations with the income from the subsidiary farming components such as dairy, sheep/ goat rearing, pig farming, beekeeping, mushroom farming, and sericulture.
- **Revalidation of recommended fertilizer dose for medium and long duration rice varieties:** In transplanted rice, application of 125% of recommended dose of fertilizer (*Kharif*- 125:62:62 and Summer- 150:75:75, N: P: K kg/ha) in medium and long duration varieties enhanced the grain yield (6.2 t/ha) by 10% and straw yield (7.6 t/ha) by 8% with B:C ratio of 2.1:1 as compared to application of 100% recommended dose of fertilizers (*Kharif*- 100:50:50 N: P: K kg/ha and Summer- 120:60:60) with yield (5.5 t/ha) and B:C ratio of 2:1.
- **Use of microbial consortia in small millets**
 - ✓ Little millet: Application of 100% RDF (20:20:20 kg/ha) along with seed treatment (5 ml/kg of seed) and soil application of liquid bio fertilizers (6.25 l/ha with 500 kg/ha of FYM applied in furrows during sowing) enhanced grain (15.3 q/ha) and straw yield (3.4 t/ha) as compared to RDF alone (grain: 12.3 q/ha & straw: 2.7 t/ha).
 - ✓ Proso millet: Application of 100% RDF (20:20:00 kg/ha) along with seed treatment (5 ml/kg of seed) and soil application of liquid bio fertilizers (6.25 l/ha with 500 kg/ha of FYM applied in furrows during sowing) enhanced grain (16 q/ha) and straw yield (2.8 t/ha) as compared to RDF alone (grain: 13.8 q/ha & straw: 2.4 t/ha).
 - ✓ Barnyard millet: Application of 100% RDF (20:20:00 kg/ha) along with seed treatment (5 ml/kg of seed) and soil application of liquid bio fertilizers (6.25 l/ha with 500 kg/ha of FYM applied in furrows during sowing) enhanced grain (23.1 q/ha) and straw yield (5.2 t/ha) as compared to RDF alone (grain: 18.7 q/ha & straw: 4.3 t/ha).
- **Pre or post emergence herbicide application for weed management in soybean:** Application of pre-emergence herbicide, diclosulam 84 WDG @ 26 g/ha reduces the weed count (30 DAS: 14 /m², 60 DAS: 21 /m²) and dry weight of weeds (30 DAS: 1.44 g/m², 60 DAS: 3.47 g/m²) and higher yield (18 q/ha), net returns (Rs. 39,918) and B:C ratio (2.38:1) **or** application of post emergence herbicide fluazifop -p- butyl 11.1% + fomesafen 11.1% SL @ 676 g/ha effectively reduces the weed count (30 DAS: 21.6 /m², 60 DAS: 28.3 /m²) and dry weight of weeds (30 DAS: 2.64 g/m², 60 DAS: 4.2 g/m²) and higher yield (17.6 q/ha), net returns (Rs. 38,730) and B:C ratio (2.36:1).
- **Application of organic manures in niger:** Under organic conditions, Basal application of Two tons compost /farm yard manure + N equivalent of 8 kg Nitrogen through compost /farm yard manure, 500

litres of jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 6.6-6.7 q/ha and B:C ratio of 1.94:1 **or** Basal application of Two tons compost /farm yard manure + N equivalent of 8 kg Nitrogen through compost /farm yard manure, 72 kg Cakes and 250 litres of jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 6.4-6.5 q/ha and B:C ratio of 1.89:1. This practice enhanced the organic carbon in soil from 0.45 per cent to 0.82 per cent.

- **Application of organic manures in groundnut:** Under organic conditions, Basal application of Three tons compost /farm yard manure + N equivalent of 10 kg Nitrogen through compost /farm yard manure, 625 litres of Jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 23 q/ha and B:C ratio of 2.8:1 **or** Basal application of three tons compost /farm yard manure + N equivalent of 10 kg Nitrogen through compost /farm yard manure, 90 kg Cakes and 313 litres of jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 22 q/ha and B:C ratio of 2.74:1. This practice enhanced the organic carbon in soil from 0.41 per cent to 0.89 per cent.
- **Application of organic manures in sunflower:** Under organic conditions, Basal application of three tons compost /farm yard manure + N equivalent of 15 kg Nitrogen through compost /farm yard manure, 938 litres of jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 21 q/ha and B:C ratio of 3.11:1 **or** Basal application of Three tons compost /farm yard manure + N equivalent of 15 kg Nitrogen through compost /farm yard manure, 134 kg cake and 469 litres of jeevamrutha should be applied before inter cultivation and spraying 3 per cent panchagavya during flowering stage (6 litres panchagavya can mix it with 200 litres water) recorded yield of 20 q/ha and B:C ratio of 3:1. This practice enhanced the organic carbon in soil from 0.44 per cent to 0.83 per cent.
- **Revalidation of nutrient management practices to achieve balanced nutrition for high yield castor:** Under rainfed conditions, application of recommended dose of fertilizer (40:40:25 N:P:K kg/ha) + 20 kg/ha zinc sulphate followed by foliar application of 2% water soluble 19-19-19 during 35-40 days after sowing enhanced yield (15.9 q/ha) by 13%, gross returns (Rs. 86933/ha), net returns (Rs. 57550/ha), and benefit cost ratio (2.96:1)
- **Post-emergent herbicide application for weed management in sugarcane:** Application (when weeds are in 3-4 leaf stage) of 2,4-D sodium salt 44% + metribuzin 35% + pyrazosulfuron ethyl 1.0% WDG @ 1200 ml/ha effectively reduces the weed population count (1-3 /m²) and total dry weight of weeds (1-2 g/m²) and higher cane yield (193 t/ha), net returns (Rs. 3,56,543) and B:C ratio (2.87:1) when compared to application of presently recommended metribuzin 70% WP (yield: 185 t/ha, net returns: 3,29,496 and B:C ratio – 2.74:1) in sugarcane
- **Post-emergent herbicide application for weed management in cotton:** Application of post-emergent glufosinate ammonium 12.8% + metolachlor 30% EW @ 4100 ml/ha effectively reduces the weed count (4-8 /m²) and total dry weight of weeds (3-10 g/m²) and higher seed yield (22.3 q/ha), net returns (Rs. 73,988) and B:C ratio (2.32:1) as compared to hand weeding twice at 20 and 40 DAS (23.1 q/ha) when

compared to application of presently recommended metolachlor 50% EC (yield: 15.1 q/ha, net returns: 32,647 and B:C ratio – 1.62:1) in cotton.

- **Intercropping system in cotton:** The intercropping systems, cotton + cluster bean (1:2) recorded higher seed equivalent yield (15.8 q/ha), net return (Rs.68473/ha) and BC ratio (1.80:1) and cotton + groundnut (1:2) recorded seed cotton yield of about 14.8 q/ha with net returns of Rs.67028 and 1.84:1 B:C ratio as compared to sole cotton (1206 kg/ha, Rs. 47071 and 1.65 respectively) crop.
- **Standardizing drone-based operations for finger millet:** The height of spray is 1.5 meter above crop canopy with a forward speed of 3 meter per second. Spray volume of 35 l/ha and 55 l/ha for early and later stages of the crop respectively against 500 l/ha in conventional spray. About 15 per cent of the same can be saved in drone spray over conventional method. Foliar spray of water-soluble fertilizer and growth hormones (19-19-19 @ 1%, pulse magic and KNO₃) through drone distributed them uniformly throughout the crop and resulted in 4% higher grain yield compared to conventional spray.
- **Polyhouse based rain water management for sustainable agriculture:** Rain water harvesting mechanism installed over the polyhouse using gutter and down pipe connected to storage tank is an ideal rain water conservative measure and further stored water could be used for cultivation. Storage tank of 7,20,000 litres capacity (24 m length, 10 m width and 3 m depth) can be constructed using RCC material over the roof top of poly houses built on 15 guntas area. Irrigation can be scheduled through drip while water soluble fertilizers can be supplied through fertigation for the entire crop growth period. High value crops like French bean, Brinjal, Broccoli, Capsicum, Pole beans, Cherry tomato, Lettuce, Palak, Spinach and other leafy vegetables are recommended to be grown under this protected practice. This has proved to be a valuable tool especially in dryland areas to increase crop yields by making best use of available water resources for 280-300 days through solar enabled drip irrigation system. Overall, a net income of Rs. 2,71,500 and a B:C ratio of 4.57:1 (from broccoli, capsicum and beans) can be obtained from a 15-gunta polyhouse.

Soil Science & Agricultural Chemistry (2)

- **Effect of fertigation on yield of maize under paired row planting system:** The paired row planting system in maize (30 cm between paired row as well as plants and 60 cm between rows) enhances water and nutrient efficiency by optimizing root zone coverage through drip irrigation. Irrigation is to be provided once in 2-3 days considering the (0.8 Epan value) prevailing climatic condition. 25% of the recommended phosphorus is applied as basal dose through conventional fertilizers. Complete dose of N&K along with 75% of recommended P applied through fertigation scheduled from 15th day to 85th days after sowing at four days interval enhances the grain (70-76 q/ha) and by 14% and fodder yield (21-23 t/ha) by 10 per cent with 2.46:1 B:C ratio as compared to soil application of conventional fertilizers (cob yield: 62-65 t/ha, fodder: 19-20 t/ha, B:C ratio – 2.43:1).
- **Effect of fertigation on yield of baby corn under paired row planting system:** The paired row planting system in baby corn (30 cm between paired row and 15 cm between plant to plant and 60 cm between rows) enhances water and nutrient efficiency by optimizing root zone coverage through drip irrigation. Irrigation is to be provided once in 2-3 days considering the (0.8 Epan value) prevailing climatic condition. 25% of the recommended phosphorus is applied as basal dose through conventional fertilizers. Complete

dose of N&K along with 75% of recommended P applied through fertigation scheduled from 10th day to 65th days after sowing at four days interval enhances the cob yield (12-13 t/ha) by 15 per cent and fodder yield (27-30 t/ha) by 10 per cent with 2.42:1 B:C ratio as compared to soil application of conventional fertilizers (cob yield: 10-11 t/ha, fodder: 21-26 t/ha, B:C ratio – 2.28:1).

Horticulture (2)

- **Optimal plant spacing for better plant growth, yield and quality of broccoli:** Broccoli planted during October – November months at a spacing of 45 cm between rows and 45 cm plant to plant within a row (45 cm x 45 cm) was found to have better vegetative growth, quality (head compactness 22.93 g/cm³), higher yield (178.35 q/ha) and B:C ratio 3.22:1 as compared to other plant spacings (45 cm x 30 cm spacing: yield: 137 q/ha, B:C ratio – 2.31:1).
- **Plant nutritional recommendations for better plant growth, yield and quality of broccoli:** In broccoli planted during October – November months, application of 50% of Nitrogen (75 Kg), 100 kg Phosphorous and 75 kg Potassium fertilizers at the time of transplanting and remaining 50% of nitrogen (75 Kg) applied 30 days after transplanting found to have better vegetative growth, quality (head compactness 21.60 g/cm³), flower head yield (203 q/ha) of broccoli and B:C ratio 3.41:1 as compared to other fertilizer doses (100:63:100 kg NPK/ha: yield: 154 q/ha, B:C ratio – 2.66:1).

Sericulture (1)

- **Management of thrips and mites in mulberry:** Spraying abamectin 1.9% EC @ 0.75 ml/l significantly reduced thrips (96.3%) and mites (94.6%) population and increased the leaf yield by 16.9%, effective rate of rearing (98%) and egg recovery (55 g/kg) with B:C ratio of 3.41:1 or Spraying diafenthiuron 50% WP @ 1g/l reduced thrips (95.3%) and mites (93.5%) infestation and increased the leaf yield by 19.9%, effective rate of rearing (98%) and egg recovery (54.6 g/kg) with B:C ratio of 3.38:1

Crop Protection (8)

Entomology (5)

- **Management of pod borers in pigeonpea:** Spraying of indoxacarb 14.5 SC @ 0.8 ml/l at bud formation and flowering stage, chlorantraniliprole 18.5 SC @ 0.3 ml/l at pod setting stage and lufenuron 5.4 EC @ 1 ml/l at pod development stage reduces pod borer infestation and enhanced economic yield (2172 kg/ha) with highest Incremental Cost Benefit Ratio (ICBR) of 7.13:1.
- **Management of pulse beetle on cowpea and blackgram seeds during storage:** Treating 10 kg of cowpea and black gram seeds with broflanilide 300 SC @ 1ml/50 ml water protects seeds from infestation up to 6 months of storage with germination of 88% in cowpea and 86% in blackgram seeds after 6 months of storage with B:C ratio of 4.38:1
- **Rodent management in paddy and sugarcane:** Placement of Brodifacoum (0.005% BB) wax blocks in burrows and sides of the bunds (10g wax blocks at 40 places per acre) at tillering and panicle formation stage in paddy crop reduced the rodent population by 83 per cent with B:C ratio of 3.56:1 while twice per month with a duration gap of 15 days from first application (10g wax blocks at 40 places per acre) in the month of August and November in sugarcane crop (or two months after the first month of application) significantly reduced the rodent population by 84 per cent with B:C ratio of 4.9:1.
- **Management of rice gall midge in paddy:** Foliar spray of fipronil 5 SC @ 2 ml/l was highly effective in reducing the gall midge population over presently recommended chemicals (140% better than

Monocrotophos and 86% better than carbofuran) and enhanced yield (61.6 q/ha) by 17-21 per cent with B:C ratio of 3.25:1 or Spray of carbosulfan 25 EC @ 2 ml/l water was proved to be highly effective for the management of Asian rice gall midge over presently recommended chemicals (130% better than Monocrotophos and 77% better than carbofuran) and enhanced yield (57.2 q/ha) by 9-13 per cent with B:C ratio of 2.94:1

- **Management of rice hispa beetle in paddy:** Foliar spray of carbosulfan 25 EC @ 2 ml/l water was highly effective in managing rice hispa beetle over presently recommended chemicals (92% better than Monocrotophos) and enhanced yield (62 q/ha) by 15-19 per cent with B:C ratio of 3.3:1

Plant Pathology (3)

- **Management of root-knot nematode in cucumber under protected condition:** Enrich *Bacillus amyloliquefaciens* @ 4 kg/acre with the recommended dose of farmyard manure and allow it to incubate for 15 days. Application of this enriched bioagent mixture to the soil at the time of transplanting and reapply (45 days after transplanting) the bioagent around the basin of each plant suppress the root-knot nematode population and promote healthy root establishment, enhances yield (261 q/ha) by 9.5% in cucumber under protected condition with B:C ratio of 2.56:1.
- **Management of root-knot nematode in capsicum under protected condition:** Spot application of *Glomus mossae* @ 1 kg along with 5 kg of farm yard manure and soil application of *Pochonia chlamydosporia* @ 1 kg along with 5 kg of farm yard manure at 45 days after transplanting suppresses nematode infestation, enhances yield (300 q/ha) by 84% in capsicum under protected cultivation with B:C ratio of 2.94:1.
- **Integrated management of tomato leaf curl virus disease:** Grow two rows of multi-cut fodder sorghum (CoFS-29) as live barrier around the main field, 45 days before planting tomato. Plant 30 days old tomato seedlings raised over silver reflective row mulch under 50X nylon mesh. Spray Imidacloprid 17.8 % SL @ 0.5ml/l during 2nd & 8th week after transplant, spray seaweed bio molecule LBD-12 (AGFORT/ Tomotough) @ 1 ml/l @ 3rd, 5th and 7th week, spray neem soap @ 8gm-l / neemark 5000 ppm @ 5ml/l during 4th week and thiamethoxam 25 WG @ 0.5 gm/l during 6th week after transplanting. Integration of these management practices significantly reduces the disease incidence to the maximum extent (71% higher than present pop) with only 1.9 per cent disease incidence, higher yield (30.4 t/ac) and B: C ratio of 7.74:1