KRISHIMELA - 2023

TECHNOLOGIES OF 2022-23

Small millets are grown in a variety of agro-ecological situations *viz.,* plains, coast and hills as well as in diverse soils with varying rainfall situations. They are known for resilience and drought enduring capacity and are relatively less prone to major pests and diseases. Generally, millets contains significant amounts of amino acids like methionine and cysteine. The richness in calcium, phosphorous, iron, dietary fiber, polyphenol and protein contents in millets make them unique among the cereals. In view of these nutritional properties, these millets have been designated as "Nutricereals". They are rich in compounds that help against several chronic diseases like strokes, cardiovascular diseases, cancers, obesity and Type II diabetes.

University has released eight high yielding varieties in millets *viz.,* Ragi: KMR-316 & ML-322, Foxtail millet: GPUF-3, Brown top millet: GPUBT-2, Little millet: GPUL-6 & GPUL-11, Proso millet: GPUP-28 & GPUP-32 in last three years. Scientific cultivation practices for sustainable and higher millets yield have been developed.

University has the mandate to provide precise and sustainable technology back-up for the prosperity of the farming community of the Karnataka State by coordinating location specific research programmes in 12 Agricultural Research Stations situated in 10 southern districts of the state while ensuring food security by enhancing productivity and agricultural resource efficiency with no adverse effects.

A. New Varieties Released

Five varieties viz., One hybrid in sunflower and four varieties (1 each in ragi, little millet, proso millet and jackfruit) have been released during 2022-23.

FINGER MILLET (RAGI): ML-322

- Duration: 105-110 days
- Grain Yield: Rainfed:10-12 q/acre
  Irrigated:15-20 q/acre
- Straw Yield: 2.0-2.2 t/acre
- Possess stiff stalk that resists lodging
- More number of tillers (6-7)
- Resistant to neck and finger blast and is drought tolerant
- Releases less chaff dust during threshing
- Recommended for cultivation in Zone - 5



Finger Millet (Ragi): ML-322

LITTLE MILLET: GPUL-11

- Duration : 90-95 days
- Grain yield : 6.1-8.1 q/acre
- Straw yield : 1.2-1.5 t/acre
- Arched shaped inflorescence with intermediate compact panicle.
- Oval shaped grain with dark grey colour
- Suitable for sowing in *kharif* season (June-July)
- Highly resistant to grain smut and leaf blight disease
- Recommended for cultivation in Zone-5 & 6



Little Millet: GPUL-11

PROSO MILLET: GPUP-32



Proso Millet: GPUP-32

- Duration : 80-85 days
- Grain yield : 7.2-8.1 q/acre
- Straw yield : 1.2-1.5 t/acre
- Intermediate compact with diffused shaped inflorescence
- Semi-tall variety
- Oval shaped golden yellow colour grain with higher test weight
- Suitable for sowing in *kharif* (June-July)
- Highly resistant to grain smut and brown spot disease
- Recommended for cultivation in Zone-5 & 6

SUNFLOWER: KBSH-85

- Duration : 95-98 days
- Seed Yield: 8.9-10.5 q/acre
- Oil Yield : 3.6-4.0 q/acre
- Medium height
- Sturdy stem plant type category
- Resistant to downy mildew
- Recommended for cultivation in Zone-5 & 6



Sunflower: KBSH-85





Jackfruit: GKVK Red Jack

JACKFRUIT: GKVK RED JACK

- Early bearing (3.5 years from planting)
- Yield (10 year old tree) : 120-150 fruits /tree/year
- 600-700 g flake weight per kg fruit
- Flakes: medium size, coppery red colour, crisp, oblong with excellent taste, each weighing 25 to 35 g
- Fruit: Oblong shape, medium sized (5.5-10 kg /fruit), small central core, outer green rind is thin (<1.50 cm) weighing 300-400g per kg fruit weight
- Highly preferred for table purpose and processing into squash
- Flake to fruit ratio is good (0.63)
- TSS: 25 to 30° Brix
- Small seeds with 20 seed weight of about 100-130g
- Suitable for commercial cultivation for its red colour flakes with excellent taste and gum less trait in ripe fruits
- Total carotenoid (604.75 µg/100g), lycopene (4.30µg/100g) and lutein (20.68 µg/100g) content is higher compared to other red flake types
- Recommended for cultivation in Zone-5

A. New Technologies Developed for Inclusion in Package of Practices

CROP PRODUCTION (15)

AGRONOMY (8)

- **Suitable sowing windows in foxtail millet in the context of climate change:** Sowing foxtail millet in the first fortnight of July compared to the current recommendation (August: grain yield: 11.8 q/ha and fodder yield: 2.2 t/ha) recorded 19.5% higher grain yield (14.1 q/ha), 20% higher fodder yield (2.6 t/ha) with B:C ratio of 2.35:1.

- **Weed management with post-emergence herbicides in kodomillet:** Spraying of metsulfuron methyl (10%) + chlorimuron ethyl (10%) WP-20 WP (2+2) powder @ 8g/acre as post-emergence herbicide or 2,4-D sodium salt 80 % powder (375 g/acre) mixed in 200 l of water when weeds are at two to four leaf stage reduced the weed density by 97% and 63% respectively compared to unweeded control with increase in yield by 92% and 61% and B:C ratio by 2.13:1 and 1.79:1 respectively.



Metsulfuron methyl (10%) + Chlorimuron ethyl (10%) WP-20 WP (2+2) powder



2,4-D Sodium salt 80% powder

- **Suitable spacing for enhance yield in browntop millet:** Sowing seed with 18 to row spacing and 4 inch plant to plant spacing compared to current recommendation (12 inch spacing: grain yield: 11.7 q/ha and fodder yield: 2.3 t/ha) resulted in 20% higher grain yield (14.1 q/ha) and fodder yield (17.9%, 2.7t/ha) with B:C ratio (2.74:1).



18" x 4"



12" x 4"

- **Suitable sowing windows in browntop millet in the context of climate change:** Sowing browntop millet in the first fortnight of July compared to current recommendation (June: grain yield: 9.7 q/ha and fodder yield: 2.1 t/ha) recorded 18.6% higher grain yield (11.5 q/ha), 16.5% higher fodder yield (2.4 t/ha) with B:C ratio of 2.3:1.

- **Fertigation in aerobic rice:** Recommended nitrogen (100kg/ha) and potash (50 kg/ha) fertilizers divided into 12 equal proportions and applied once a week starting from sowing to grain filling stage through fertigation enhanced the B:C ratio (2.58:1 to 3.11:1), fertilizer utilization efficiency from 40% to 75% and yield by 17% (58 q/ha to 68 q/ha).





- **Post-emergence chemical weed control in paddy wet nursery:** Spraying of bispyribac sodium (10% SC) @ 7.5 ml/15 l of water as post-emergence herbicide on 12th day after sowing in 3 gunta area of wet nursery bed when weeds are at 2-4 leaf stage reduced weed count by 99% and dependency on labourers.
- **Post-emergence chemical weed control in paddy dry nursery**: Spraying of bispyribac sodium (10% SC) @ 7.50 ml / 15 l of water as post-emergence herbicide on 12th day after sowing in 3 gunta area of dry nursery bed when weeds are at 2-4 leaf stage reduced weed count by 95-99% and dependency on labourers.
- **Weed management with post-emergence herbicides in sunflower:** Whenever pre-emergence herbicides cannot be used, apply post-emergence herbicide, quizalofop-p-ethyl 5% EC @ 1.5ml/l at 15-20 days after sowing (when weeds are at two to three leaf stage) and one intercultural operation at 30 days after sowing reduced the weed density by 75% and increased the yield by 13% with reduction in cost (B:C ratio of 3.11:1) of weed management by 60%.



SOIL SCIENCE & AGRICULTURAL CHEMISTRY (3)

- **Utilization of Slag Based Gypsum for sustainable yield in maize:** Along with the recommended dose of fertilizer, application of slag-based gypsum @ 180 kg/acre enhanced the yield by 16.5% with B:C ratio of 2.38:1 or application of commercially available gypsum @ 180 kg/acre once a year in maize crop before sowing enhanced the yield by 12.1% with B:C ratio of 2.33:1.





- **Mechanized Drum Composter– A simple method of composting waste:** In this method, wet and dry organic waste materials generated should be mixed in 1:3 ratio all the time. At the time of filling the waste material into the drums, it should be mixed with microbial consortia or cow dung slurry to speed up the decomposition and 60 percent moisture should be maintained. Later, 15-20 rotations of the drums twice a day with a hand-rotating device will speed up the decomposition process by facilitating aeration. By doing this, compost will be ready in about 75 days. While, if the drums are mechanically motored and rotated 2-3 times a day for 5 minutes, compost will be ready in about four weeks duration. In this system, the liquid waste produced during the decomposition can be collected in trays below the drums and could be sprayed to the crops in 1:10 ratio of liquid and water. Mechanized drum composter of 50 liter capacity can produce about 30 kg of compost in about 30-35 days.




- **Utilization of Slag Based Gypsum for sustainable yield in paddy:** Along with the recommended dose of fertilizer, application of slag-based gypsum @ 180 kg/acre enhanced the yield by 14.7% with B:C ratio of 1.88:1 or application of commercially available gypsum @ 180 kg/acre once a year in paddy crop before transplanting enhanced the yield by 9.9% with B:C ratio of 1.83:1.





AGRICULTURAL MICROBIOLOGY (2)

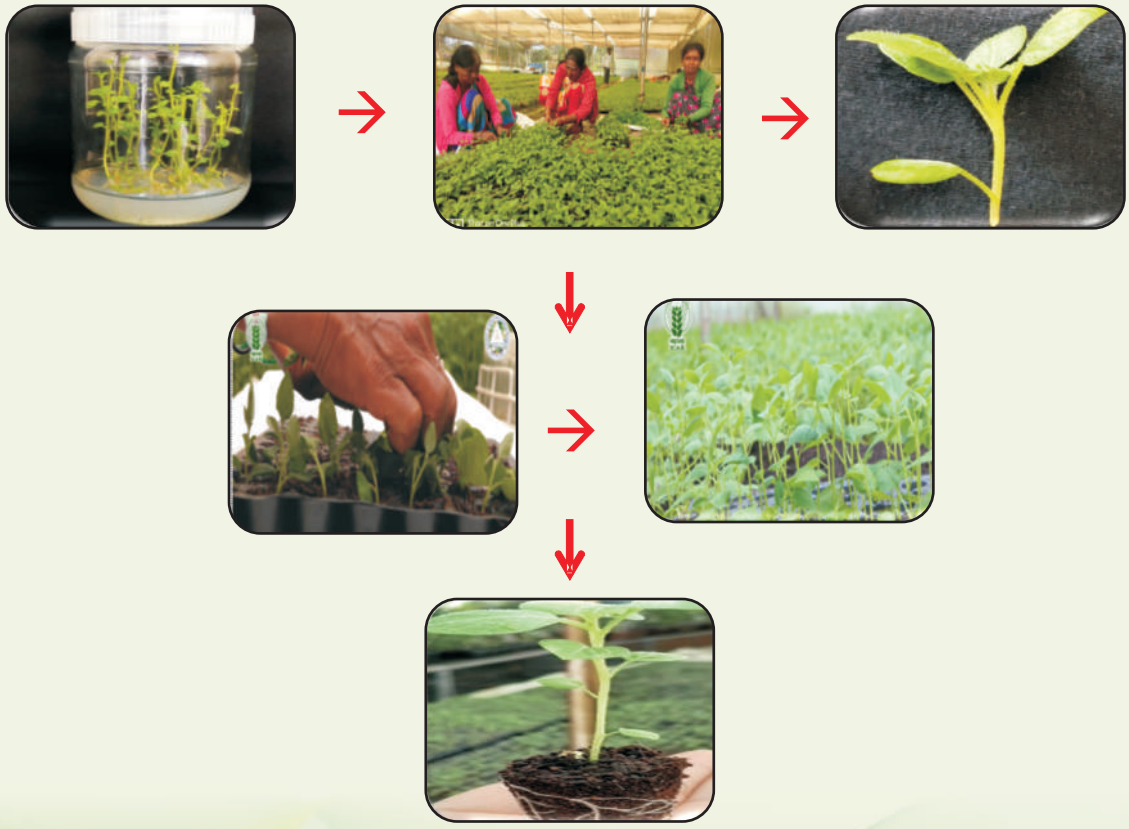
- **Acetic acid for increasing the storage life of oyster mushroom (*Pleurotus eous*):** Treating 1 kg of oyster mushroom with 480 ml of 1% acetic acid for 10 minutes then air dry for 2 minutes and packed in tight High Density Polyethylene (HDPE) bags and storing in refrigerator at 4°C enhanced the shelf life of oyster mushroom by 6 days with an expenditure of Rs. 3.70 per kg mushroom.



- **Application of liquid biofertilizer through drip irrigation in sugarcane:** Application of liquid biofertilizer microbial consortia (Azotobacter + Azospirillum + Pseudomonas + Bacillus) @ 2 l/acre mixed in 200 l of water at 30 and 60 days after planting along with recommended 75% fertilizers through drip irrigation increased the nutrient availability and microorganisms in the soil and reduced the fertilizer requirement by 25% with 168 t/ha yield and 2.36:1 B:C ratio.

HORTICULTURE (2)

- **Apical Rooted Cuttings of potato for seed tuber production:** Disease-free saplings grown in Tissue Culture bottles are selected and roots are carefully separated from culture media. Dip the saplings in 2% fungicide and then transplant to mother bed (a bed prepared with coco-peat). 21 days after transplantation, the first apicals are available to cut. The cut apicals are again transplanted to the mother bed for further multiplication up to two months. Where, each tissue culture sapling produces 100 saplings by the end of two months. After two months and based on the farmers need, apicals are cut and transplanted to protrays. After fourteen days of nourishment, rooted saplings are ready for transplantation in open field conditions. Later, saplings are transplanted by following 60x20 cm spacing and other cultivation practices mentioned in the Package of Practices. Harvesting can be done at 90-110 days and harvested potato tubers are used as Germination-0 seed material for sowing. This can be used as seed material for three generations. While using rooted cuttings for planting provide recommended chemical fertilizer in four splits at ten days interval in raised beds with need based plant protection measures as in Package of Practices.



➢ **Mechanization in Potato Cultivation:**

- **Tractor operated potato planter -** In modern mechanized potato farming, whole tubers can be planted with a tractor-driven potato planter. About 1 quintal of sowing tubers can be loaded in this planter and it forms one feet raised beds. Two people can sit behind the planter and put the tuber into the measuring wheel where tubers will be placed at a depth of 10-12 cm by covering the tuber with the soil about 4-5 cm, simultaneously using soil cover plate. Through this, sowing of 1 acre area can be done in 2 hours. Germination to the extent of 88% and tuber yield of about 12.6 t/ha can be obtained through this planter while germination to the extent of 72% and tuber yield of about 8.52 t/ha can be obtained through manual sowing.
- **Boom sprayer** - Plant protection chemicals can be sprayed in less than 1 hour/acre there by controlling pest and diseases.





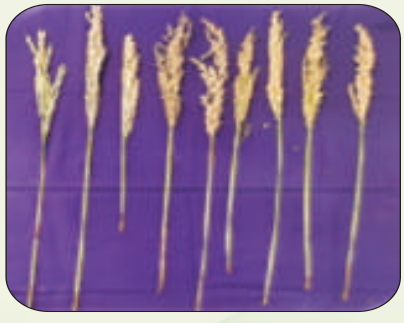
CROP PROTECTION (15)

ENTOMOLOGY (10)

➢ **Management of yellow stem borer in paddy:** Broadcasting of granular insecticide, chlorantraniliprole 0.4% GR @ 4 kg/ acre at 20 days after planting reduced the incidence of yellow stem borer by 93% with 75 % enhanced yield (53.2 q/ha) over control and B:C ratio of 2.02:1



Treated Plot



Untreated Plot

- **Management of brown plant hopper in paddy:** Foliar spray of triflumezopyrim 10 SC @ 0.40 ml/l when 5-10 grasshoppers per stem is observed, reduced the pest incidence to the extent of 99% with B:C ratio of 2.87:1 and 6% to 15% higher grain yield (60 q/ha).


Treated Plot


Untreated Plot

- **Management of ear head bug in paddy:** Foliar spray of fipronil 5% SC insecticide at 2 ml/l of water when 1-2 bugs per plant is observed during milk filling stage reduced the incidence by 96% with 64% enhanced yield (60 q/ha) and B:C ratio of 3.09:1.


Eggs


Earhead Bug


Infested earhead


Chaffy seeds

- **Management of pod fly in pigeonpea:** Spraying of lufenuron 5.4 EC @ 1ml /l of water twice at an interval of 15 days at pod setting and pod development stages reduced the pod damage by 56% and seed damage by 77% with B:C ratio of 3.63:1.


Pod Fly


Damaged Pod


Damaged seeds

- **Management of mirid bug in cotton:** Spraying dinotefuran 20 SG @ 0.3 g/l of water at bud setting and fruit development stage reduces the mirid count to the extent of 87% and enhanced the yield by 60% (24.4 q/ha) with B:C ratio of 3.41:1.


Mirid bug


Damaged plant



Damaged bud

- **Management of diamond backmoth in cabbage:** When the incidence of diamondback moth is noticed on cabbage, spraying of broflanilide 30% SC @ 0.08 ml/l of water reduced incidence by 97% and enhanced yield (23 t/ha) by 13% with B:C ratio of 3.3:1 or Spraying fluxametamide 10% EC @ 0.8 ml/l of water when we observe the diamond backmoth in cabbage reduced incidence by 96% and enhanced yield (21 t/ha) by 12% with 3.1:1 B:C ratio



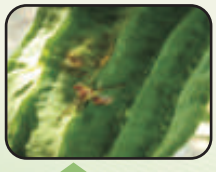


- **Management of storage pests in pulses:** After threshing the pulses, dry them till the seed moisture is less than 10% and then apply 0.4 ml flupyradifurone 200 SL mixed in 50 ml of water for 10 Kg seeds. Later, dry them in shade for 3-4 hours and store in gunny bag. This seed treatment inhibits legume insect infestation (1.5%) up to 9 months with 4.5:1 B:C ratio and preserves the seed quality.
- **Management of thrips in chilli:** When the infestation of thrips, is noticed in chilli, spraying of broflanilide 30% SC @ 0.16 ml/l of water (B:C ratio- 3.31:1 and pest incidence reduction: 92.7%) or fluxametamide 10% EC @ 0.8 ml/ l of water (B:C ratio- 3.22:1 and pest incidence reduction: 87.2%) or spinetoram 11.7% SC @ 1 ml / l of water (B:C ratio- 3.01:1 and pest incidence reduction: 84.9%) or tolfenpyrad 15% EC @ 2ml / l of water (B:C ratio- 2.96:1 and pest incidence reduction: 83.6%) is found effective in minimizing the damage. It is suggested not to use any of the above-mentioned pesticides for a second application on the same crop.





- **Management of fruit fly in ridgegourd:** When fruit fly damage is found in ridge gourd, spraying the mixture of cyantraniliprole 10.26 OD @ 1.8 ml and 10 g jaggery/ l of water, followed by need based second application with the mixture of spinosad 45 SC @ 0.3 ml and 10 g jaggery /l of water after 15 to 20 days of first spray reduced the incidence by 92% and enhanced yield by 22% (81q/ha) with B:C ratio of 3.6:1.


➢ **Management of peafowl in agricultural crops:**

- Arranging the reflective ribbons of 2 inch width in grid format with spacing of 6 ft x 6 ft with a twist towards north to south direction around crop area and 2 feet above the crop canopy significantly reduced the peafowl menace and enhanced the crop yield by 11.5 and 17.8 per cent in ragi and groundnut crop, respectively with the B:C ratio of 1.19:1 and 1.62:1.




- Arranging the coconut fiber ropes in grid format with spacing of 6 ft x 6 ft around crop area and 2 feet above the crop canopy significantly reduced the peafowl menace and enhanced the crop yield by 9.6 and 14.9 per cent in ragi and groundnut crop, respectively with the B:C ratio of 1.17:1 and 1.6:1.




Note: Ropes/ribbons must be placed immediately after sowing (up to 15-20 days) and during the grain formation stage till harvest, depending on the crop and infestation.

PLANT PATHOLOGY (5)

➢ **Management of bacterial blight in paddy:** Seed treatment with 0.5 g streptocycline + copper oxychloride 1 g/l of water (soak whole seeds overnight) along with spraying 0.2 g streptocycline + copper oxychloride 1g/l liter of water as soon as the disease is observed will reduce the disease by 79% with enhanced yield (38 q/ha) and B:C ratio of 3.11:1.


Treated Plot


Untreated Plot

- **Management of rust disease in foxtail millet:** Seed treatment with 10g *Pseudomonas fluorescens* talc based powder per kg of seed and spraying with azoxystrobin 23% SC @ 1ml/l of water at 40-45 days after sowing followed by spraying with *Pseudomonas fluorescens* talc based powder 10g/l of water at 50-55 days after sowing will reduce the disease by 89% with enhanced yield (15 q/ha) and B:C ratio of 2.86:1.



Treated Plot



Untreated Plot

- **Management of anthracnose in chilli:** Spraying tebuconazole 50% + trefloxystrobin 25% @ 0.4 g/ l of water as soon as the disease is observed and 2nd spray at an interval of 15 days reduces the disease incidence by 80% and enhances yield (34.8 q/ha) with 2.35:1 B:C ratio



- **Integrated management of leaf curl virus disease in chilli:** Two rows of multi-harvest fodder maize should be grown before 45 days along the borders of the field. Chilli seedlings grown for 35 days under 50X nylon mesh net should be transplanted in the mid of the silver reflective mulch row cover. Spray Imidacloprid (17.8 % SL) @ 0.5 ml/l Afidophyropen (50 g/l DC) @ 2ml/l at 15th and 70th day after planting. Sea plant biomolecule (*Kappapycus alviraizi:* LBD-12/ AGFORT/ TOMOTUFF) @ 1.5ml/l of water should be sprayed on 21st, 35th, 49th and 63rd day of transplanting. Neem oil (5000 ppm) @ 5 ml/l should be sprayed on 28th and 56th day of transplanting. Thiamethoxam (25 WG) @ 0.5 g/l should be sprayed at 6th week after transplanting. With adoption of this technology, the severity of the disease is around 3 to 7.3% with 44.3% higher yield (5.7 t/ha) and B:C ratio of 6.3:1.







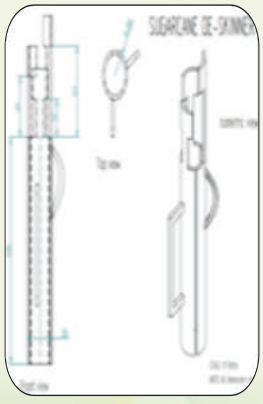
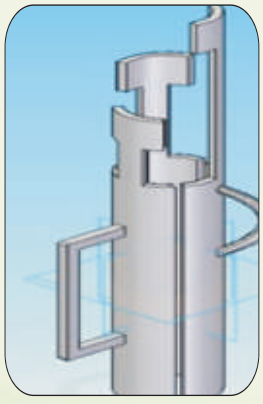


- **Management of early blight in tomato:** Spray azoxystrobin 18.2% + difenconazole 11.4% SC @ 1 ml /l of water as soon as the disease is observed and the second spray at an interval of 15 days reduces the disease incidence by 70% and yields 31.2 q/ha with B:C ratio of 2.26:1.




AGRICULTURAL ENGINEERING (2)

- **Sugarcane deskinner tool:** Food grade SS 304 material is used for the fabrication of sugarcane deskinning tool. This deskinning tool consists of a cylindrical shaft, curved blade, frame, hinges, and handle. A cylindrical shaped shaft (5cm) is divided into three parts to accommodate the varying circumferences and joined by hinges and the height of the knives is 15 cm, 8 cm and 5 cm respectively. While operating the tool, it should be held in right hand, as four fingers come on the left side and a thumb on the right side. At present most of the automatic and semi-automatic deskinning machines are available, but they are very expensive and making it difficult for small scale roadside vendors and consumers to use. As compared to manual peeling with knife, the developed deskinner at different diameters showed reduction in deskinning time and increase in juice quantity and quality.


- **Improved hand weeder for row crops:** This tool is designed for one-foot (30 cm) row spacing crops. It has a total of five tynes, three in front and two in back. It is suitable for all types of soil and crops. Its shovels are made of high carbonated iron and each shovel is 4 cm wide. Working width between the rows is 20 cm, where in simultaneous removal of weeds, loosening the top soil and opening the small furrows between the rows can be done. This tool can be pulled by rope by one person in the front and another person can hold it with both hands from behind. Weeding efficiency of the improved hand weeder is around 95% while efficiency of cycle weeder is around 80%. Cost of the hand weeder is around Rs.3,300/-





A.Varieties Recommended for Farm Trials



MAIZE: MAH-15-84

MAIZE: MAH-15-84

- Duration: 120-125 days
- Yield: 38-42 q/acre
- High yielding hybrid
- Resistant to Leaf Blight
- Tolerant to downy mildew
- Promising in Zone-5 & 6

COWPEA: KBC-12

- High yielding variety (5.6-6.1 q/acre)
- Resistant to Cowpea mosaic virus
- Resistant to leaf blight
- Promising in Zone - 5 & 6



COWPEA: KBC-12



SUNFLOWRE: KBSH-90

SUNFLOWRE: KBSH-90

- Duration : 80-82 days
- Seed Yield: 7-7.5 q/acre
- Oil Yield: 2.8 q/acre
- Medium height
- Sturdy stem
- Resistant to downy mildew
- Promising in Zone - 5 & 6

BLACK TURMERIC: CHNBT-1

- Duration : 258-265 days
- Fresh Rhizome Yield: 4.0-4.5 t/acre
- Medium height
- More number of leaves and tillers
- Larger rhizomes with bluish flesh (rhizome core)
- Promising in Zone- 6



BLACK TURMERIC: CHNBT-1



TURMERIC: IISR PRATIBHA

TURMERIC: IISR PRATIBHA

- Duration : 240-245 days
- Fresh rhizome yield: : 14-15 t/acre
- Better processing efficiency (20.8%)
- Higher curcumin content (5.37%)
- Larger rhizomes with reddish yellow flesh (rhizome core)
- Promising in Zone-6

D. Seed Production: 2022-23

No.	Crop	Breeder Seeds (q)	Quality Seeds (q)	Total (q)
1.	Cereals	79.79	12,591.73	**12,671.50**
2.	Pulses	41.48	1,437.23	**1,478.71**
3.	Oilseeds	632.41	1,758.25	**2,390.66**
4.	Others	0	28.70	**28.70**
Total		**753.68**	**15,815.91**	**16,569.59**