

Research Recommendations Released during 2026 by Mahatma Phule Krishi Vidyapeeth, Rahuri

Natural Resource Management

Agronomy

1. Pre-emergence application of Metribuzin 70% WG @ 1.25 kg a.i. ha⁻¹ or Sulfentrazone 28% + Clomazone 30% WP @ 0.700 + 0.750 kg a.i. ha⁻¹ in 500 litres of water within 3-5 days after planting followed by post emergence application of Ametryn 80% WG @ 2.00 kg a.i. ha⁻¹ in 500 litres of water at 30 days after planting is recommended for effective weed control, higher cane yield and monetary returns in *preseason* sugarcane.
2. In *adsali* sugarcane, dry leaves stripping at 210 days after planting in furrow is recommended for higher cane yield, sugar yield and monetary returns and for maintaining soil fertility.
3. For organic turmeric cultivation, the recommended dose 200 : 100 : 100 N : P₂O₅ : K₂O kg ha⁻¹ should be applied through organic sources, i.e. 25% N through FYM (10 ton) + 25% N through Vermicompost (2 ton) + 25% N through Neem cake (1 ton) and 25% N through Poultry Manure (1.5 ton) at the time of planting and bio-fertigation of Jeevamrut @ 100 liter ha⁻¹ at 60, 90, 120, 150, 180 and 210 days after planting is recommended for obtaining higher yield, monetary returns and improving the soil health.
4. Intercropping of Pigeon pea + Soybean (1:5) or Pigeon pea + Green gram (1:5) is recommended for higher yield, monetary returns and improving the soil health under organic cultivation.
5. The Integrated Organic Farming System (IOFS) model developed by Mahatma Phule Krishi Vidyapeeth, Rahuri for 1.0 ha. to small and marginal farmers under irrigated condition comprises of crops/ cropping systems (0.75ha), horticulture crops (0.20ha), livestock (0.03ha) including Dairy (4 Desi cows), Goatery (10 Does + 1 Buck), Poultry (1200 birds year⁻¹) and value addition unit (0.02ha) is recommended for higher yield, monetary returns and sustainable resource management practices, reduce green house gas emission and attracting rural youth towards Agriculture.

Integrated Organic Farming System (IOFS) model (1.0 ha)

Components	Cropping systems/ Livestock component details			Area (ha.)/ Nos.	Are a (%)
	Season				
	Kharif	Rabi	Summer		
Crops/ Cropping systems (55%)	Turmeric	Turmeric	Maize (F)	0.10	10
	Okra	Chickpea	Maize (F)	0.10	10
	Soybean	Onion	Sunnhemp	0.10	10
	Pigeon pea + Green Gram	Wheat	-	0.10	10
	Sugarcane	Sugarcane	Sugarcane	0.15	15
Forage Crops (20%)	Lucerne	Lucerne	Lucerne	0.10	10
	Hybrid Napier	Hybrid Napier	Hybrid Napier	0.10	10
Horticulture (20%)	Banana			0.10	20
	Mixed fruit crops			0.10	
Livestock (3%)					
Dairy	Desi cows		04 Nos.		3
Poultry	Kaveri		300 birds lot ⁻¹ 1200 birds yr ⁻¹		
	Goat		Osmanabadi 10 Does+1 Buck		
Value addition unit (2%)	Bio input Resource Centre (BRC) and Value addition		0.02		2

Total		1.00	100
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- Plantation of bamboo species viz; *Bambusa tulda*, *Bambusa nutans*, *Bambusa balcooa* and *Dendrocalamus strictus* is recommended for **higher production of bamboo sticks** and monetary returns in scarcity zone of Western Maharashtra
- Application of 75:30:30 N:P₂O₅:K₂O kg ha⁻¹ (50% N , **100 % P & K at the time of sowing** and remaining 50% N at 30 DAS) to *kharif* sesame is recommended for higher yield and monetary returns in Maharashtra.
- In Roselle based cropping system, for higher production and monetary returns, Roselle-Groundnut cropping system is recommended.

Soil Science

- An application of 80% nutrients through fertigation to *summer* brinjal as per STCR yield target (35-45 t ha⁻¹) equation with FYM is recommended for higher yield and monetary returns.

STCR equation with FYM (10 t ha⁻¹) for *Summer* Brinjal

$$FN = (7.23 \times T) - (0.52 \times SN) - (1.56 \times FYM)$$

$$FP_2O_5 = (3.21 \times T) - (3.10 \times SP) - (0.50 \times FYM)$$

$$FK_2O = (4.74 \times T) - (0.26 \times SK) - (0.74 \times FYM)$$

Weekly nutrients splits through fertigation schedule for *Summer* Brinjal

Days after transplanting	Nitrogen (%)	Phosphorus (%)	Potassium (%)
1- 4 weeks	30	30	10
5-7 weeks	15	30	20
8-11 weeks	15	20	20
12-21 weeks	40	20	50
Total	100	100	100

- Application of two foliar sprays of 1% water soluble fertilizer (19:19:19) at 30 and 45 days after sowing along with general recommended dose of fertilizers to sweet corn for higher yield and monetary returns is recommended in Maharashtra. (General recommended dose of fertilizer 120:60:40 N:P₂O₅:K₂O kg ha⁻¹ + FYM 10 t ha⁻¹)
- Application of general recommended dose of fertilizers 60:30 N and P₂O₅ kg ha⁻¹ through Urea-DAP briquettes (170 kg ha⁻¹) and 50 kg ha⁻¹ K₂O through muriate of potash (84 kg ha⁻¹) + FYM 10 t ha⁻¹ at the time of transplanting of paddy along with two foliar sprays of Zn EDTA @ 0.2 % (2 g L⁻¹) + boric acid @ 0.5 % (5 g L⁻¹) at tillering and Panicle initiation stage is recommended for higher grain yield and monetary returns in Maharashtra.
- Application of sulphur powder (80-100 mesh) @ 20% of Gypsum requirement of soil, as a soil amendment in three equal split in three years before sowing of soybean + drenching of Halo Mix Consortia @ 250 ml ha⁻¹ or VSI microbial consortia @ 20 L ha⁻¹ at 10 days after sowing of soybean and application of GRDF to soybean and wheat is recommended for higher yield of soybean-wheat cropping sequence and improvement in saline sodic soils of Maharashtra.

Recommended Technology

- Soybean GRDF: FYM @ 10 t ha⁻¹ before sowing + 50:75:45 kg N:P₂O₅:K₂O ha⁻¹ at the time of sowing
- Wheat GRDF: FYM @ 10 t ha⁻¹ before sowing + 60:60:40 kg N:P₂O₅:K₂O ha⁻¹ at the time of sowing + 60 kg N ha⁻¹ 30 days after sowing

- Halo mix consortia- *Azotobacter beijerinckii* + *Enterobacter cloacae* + *Bacillus subtilis* with microbial population $\times 10^{12}$ CFU/ml @ 250 ml ha^{-1} in 500 lit water through drenching near rootzone

OR

- VSI Consortia- *Bacillus wiedmannii* + *Bacillus sanguinis* + *Pseudomonas libanensis* + *Pseudomonas gessardii* with microbial population $\times 10^8$ CFU/ml @ 20 L ha^{-1} in 500 lit water through drenching near root zone
13. The soil application of 20 kg ha^{-1} Micro Grade-I at the time of planting or drenching of 2% Phule Liquid Micro Grade-II (10 litre in 500 litre water) at 30 and 45 days after planting of potato along with GRDF is recommended for higher tuber yield, economic returns and maintaining soil fertility. (General recommended dose of fertilizer 150:60:120 N:P₂O₅:K₂O kg ha^{-1} + FYM 20 t ha^{-1})
 14. Application of revised fertilizer dose as 440:190:190 N, P₂O₅ and K₂O kg ha^{-1} with 30 t ha^{-1} FYM is recommended to *Adsali* sugarcane for higher cane, CCS yield and monetary returns of sugarcane in medium deep soils of Maharashtra.
 15. The split application of recommended dose of nitrogen and potassium for higher cane, CCS yield and monetary returns of *adsali* sugarcane in medium deep soils of Maharashtra as per following schedule of time of application of nutrients is recommended.

Table :Fertilizer application schedule to *Adsali* Sugarcane

Sr. No.	Fertilizer Application Time	% N	% P ₂ O ₅	% K ₂ O
1	At planting	10	50	40
2	6 to 8 weeks after planting	30	--	--
3	12 to 16 weeks after planting	10	--	--
4	18 to 20 weeks at earthing up	40	50	40
5	20 weeks after planting	10	--	20

16. After harvest of banana bunch following technology is recommended for early and quality compost production from shredded banana pseudostem
 - (1) Banana pseudostem should be shredded after harvest of bunch
 - (2) Apply Urea @8 kg + Single Super Phosphate @ 10 kg per ton of shredded banana pseudostem in 100 liter water
 - (3) Apply Decomposing culture @ 1 liter per ton of shredded banana pseudostem in 100 liter water
17. Planting of bamboo species *Dendrocalamus strictus* (Manvel) is recommended for higher carbon storage (93.26 t ha^{-1}), improved soil physical, chemical and biological properties and higher soil carbon sequestration rate (7.77 t C ha^{-1} year⁻¹) in soils of Western Maharashtra.
18. Soil application of 75 per cent recommended dose of fertilizer (30:15:15 N:P₂O₅:K₂O kg ha^{-1}) and FYM 5 t ha^{-1} along with two foliar sprays of 1 per cent 19:19:19 water soluble fertilizer at tillering (25-30 DAS) and pre-flowering stage (45-55 DAS) is recommended for higher grain yield and economic returns of little millet in Western Maharashtra.
19. Application of potash 140 kg ha^{-1} through potash derived from molasses powder (PDM) 965 kg ha^{-1} to *suru* sugarcane (Co 86032) alongwith general recommended dose of N:P₂O₅ 300:140 kg ha^{-1} + FYM 20 t ha^{-1} is recommended for higher cane yield and economic return in medium deep black soils of Maharashtra.

20. Application of FYM 20 t ha⁻¹ + 75 % recommended dose of fertilizers (98, 15 and 23 N, P₂O₅ and K₂O kg ha⁻¹) along with MPKV microbial consortium (Azotobactor, Phosphate solubilizing bacteria, Potassium solubilizing bacteria and Trichoderma) through drip fertigation to broccoli is recommended for achieving higher yield, water use efficiency, fertilizer saving, improving soil biological properties and economic returns in medium deep black soils for Western Maharashtra below:

Fertigation and MPKV microbial consortium bio fertigation schedule

Water Soluble Fertilizer					Microbial Consortium		
Sr. No.	Days	Nitrogen (N)	Phosphorus (P ₂ O ₅)	Potassium (K ₂ O)	Sr. No.	Days after transplanting	(L ha ⁻¹)
		(kg ha ⁻¹)	(kg ha ⁻¹)	(kg ha ⁻¹)			
1	7	7.5	3.75	3.75	1	1	4
2	14	15	3.75	3.75	2	14	4
3	21	15	3.75	3.75	3	28	4
4	28	19	3.75	3.75	4	42	4
5	35	15	-	-	Total		16
6	42	19	-	4.00			
7	49	7.5	-	4.00			
Total		98	15	23			

Horticulture

21. High density planting in fig at a spacing of 5.0 x 2.5 m (800 plants per ha.) is recommended for obtaining higher yield and net monetary returns in Maharashtra with following package of practices.
Planting : June-July, Pit size: 45cm³, Training of plants : Beheading at 45 cm height during September, Keep 2-3 shoots per stem, Allow plant to grow as multi-stem (03 to 04) from next year and prepare raised beds of 120 cm wide and 60 cm height, Bahar management (after two years) : Pruning- Heading back to 1/3rd of total length of primary branches, Time: June-July for *Khattab* bahar, Sept.-Oct. for *Meethab* bahar, Irrigation method: drip with double lateral line, Nutrient management: 50 kg FYM+900:250:275 g N:P₂O₅:K₂O per plant (fully grown five year old plants).
22. In muskmelon use of mulching and 1.0 ft. height white colour polypropylene crop cover (17 GSM) upto initiation of flowering during summer season is recommended for obtaining higher yield and net monetary return.
23. In watermelon use of mulching and 1.0 ft. height white colour polypropylene crop cover (17 GSM) upto initiation of flowering during summer season is recommended for obtaining higher yield and net monetary return.

Animal Husbandry and Dairy Science

24. It is recommended to add 1.6 per cent ginger powder and 1.2 per cent cumin powder into Quarg cheese for preserving it up to 21 days at 5±1°C.
25. It is recommended to use unripecooked mango pulp @ 14 per cent and jaggery 10.50 per cent of paneer whey for the preparation of whey-based nutrient rich mango Panha.
26. Use of pink-peel white-fleshed dragon fruit @ 15 per cent of the milk is recommended for the preparation of value-added Paneer.
27. It is recommended to use 1 per cent Ginger powder and 3 per cent Black cumin powder in basal diet of white leghorn layers to improve the production (5.24%) and quality of eggs.

28. It is recommended to add 2 per cent Black cumin and 1.5 per cent Garlic powder as a natural growth promoter of broiler.

Basic Science

29. Treatment to the pearl millet grains in a 1350-watt microwave for 100 seconds before milling is recommended to extend the shelf life of flour up to 40 days.
30. The retrogradation method is recommended to improve the health-promoting resistant starch content in rice and sorghum as per the following steps.
- (1) Cook the native starch of rice or sorghum in water to a 1:2 ratio at 100°C for 30 minutes.
 - (2) Cool the cooked gelatinized starch to room temperature.
 - (3) After that, store the gelatinized starch at 4°C for 36 hours before using it.

Plant Protection

Entomology

31. Following insecticide spray schedule at 15 days interval is recommended for effective control of aphids, leaf hoppers and shoot and fruit borer on okra as soon as the pest crosses ETL (2 aphids/ leaf, 2 hoppers/ leaf or 5% damage of okra shoots and fruits).
- First spray - Tolfenpyrad 15 % EC @ 20 ml/10 lit. of water.
- Second spray - Lambda cyhalothrin 5 % EC @ 6 ml/10 lit. of water.
- Third spray - Chlorantraniliprole 18.50 % SC @ 2.5 ml/10 lit. of water.
32. Drone based two sprays of flubendiamide 39.35 % SC @ 150 ml/ha in 25 lit. of water at 15 days interval starting immediately after crossing ETL (1-2 larvae/m row length) are recommended for effective control of leaf eating caterpillar (*Spodopteralitura*) in soybean. (Drone spraying should be performed at a height of 2 m above crop canopy, maintaining drone speed 3.5 m/s, using high pressure flat fan nozzle when the wind speed is less than 4 km/hr.)
33. Drone based two sprays of chlorantraniliprole 18.50 % SC @ 125 ml/ha in 25 lit. of water at 15 days interval as soon as pest crosses ETL (1 larva/plant) are recommended for effective control of pod borer (*Helicoverpa armigera*) in chickpea. (Drone sprays should be performed at a height of 2 m above crop canopy, maintaining drone speed 3.5 m/s, using high pressure flat fan nozzle when the wind speed is less than 4 km/hr.)
34. Drone based two sprays of chlorantraniliprole 18.50 % SC @ 150 ml/ha in 25 lit. of water at 15 days interval as soon as pest crosses ETL (1 larva/plant) are recommended for effective control of pod borer (*Helicoverpa armigera*) in pigeonpea. (Drone sprays should be performed at a height of 2 m above crop canopy, maintaining drone speed 3.5 m/s, using high pressure flat fan nozzle when wind speed is less than 4 km/hr.)
35. Sequential sprays of chlorantraniliprole 18.50 % SC @ 3 ml, flubendiamide 39.35 % SC @ 2 ml and dimethoate 30 % EC @ 15 ml per 10 lit. of water at 15 days interval are recommended on pigeonpea crop for effective control of maruca (*Maruca vitrata*), pod borer (*Helicoverpa armigera*) and pod fly (*Melanagro myzaobtusa*) as soon as pests crosses ETL (maruca- 1 web/plant, pod borer-1 larva/plant and pod fly-2.5 % seed damage)
36. Two sprays of cyantraniliprole 10.26 % OD @ 7 ml or spinetoram 11.70 % SC @ 3 ml per 10 lit. water at 10 days interval as soon as pest crosses ETL (3 thrips/tender shoot) are recommended for effective control of grape thrips.
37. Drone based two sprays of thiamethoxam 12.6% + lambda-cyhalothrin 9.5% ZC @ 200 ml/ha in 25 lit. water, applied at 15 days interval as soon as pests crosses ETL (10 aphids/ leaf, 2 jassids/ leaf and 10 thrips/ leaf) are recommended for effective control of sucking pests in

- cotton. (Drone sprays should be performed at a height of 2 m above crop canopy, maintaining drone speed 3.5 m/s, wind speed less than 4 km/h and using high-pressure flat fan nozzle)
38. Bagging of dragon fruits with reusable nylon mesh drawstring net bags (4" x 10") is recommended for effective control of fruit fly in dragon fruit.
 39. Three sprays of Fish Oil Rosin Soap (FORS) @ 250 g or Fish Oil Rosin Liquid (FORL) @ 20 ml/10 lit. of water at 15 days interval as soon as pest incidence noticed is recommended for effective control of mealy bug on dragon fruit.

Plant Pathology

40. Two sprays of combi-fungicide azoxystrobin 18.2% + cyproconazole 7.3% SC @ 1ml per litre of water at an interval of 10 days immediately after appearance of disease are recommended for effective management of powdery mildew disease, higher yield and monetary returns in wheat crop.
41. Seed treatment with combi-fungicide prochloraz 5.7% + tebuconazole 1.4% w/w ES @ 0.3 ml per kg of seed is recommended for effective management of wilt disease, higher germination and yield of chickpea.
42. Seed treatment with combi-fungicide azoxystrobin 2.5% + thiophanate methyl 11.25% + thiamethoxam 25% FS @ 10 ml per kg of seed or carboxin 37.5% + thiram 37.5% WS @ 3 g per kg of seed is recommended for effective management of seed and soil-borne diseases, higher germination, seedling vigour index and yield of soybean.
43. Three sprays of MPKV bioconsortium (Fungal + Bacterial) @ 10g/lit. of water immediately after disease appearance at an interval of 15 days are recommended for effective management of Pokkahboeng disease of sugarcane
44. Three sprays of Gamma Irradiated Chitosan 1 % (Vasant Urja) @ 15 ml + *Ampelomycesquisqualis* 2 % WP @ 5 g/lit. of water immediately after appearance of disease at an interval of seven days are recommended for management of powdery mildew of grape.
45. The following package of practice is recommended for effective management of fusarium basal rot of onion
 - (1) Seedling root dip treatment in MPKV Consortium (Fungal + Bacterial) @ 10 g/lit. of water for 15 minutes before transplanting.
 - (2) Four sprays alongwith drenching of MPKV consortium (Fungal + Bacterial) @ 10 g/lit. of water at an interval of 15 days after transplanting.
46. Application of VSI's halophilic-halotolerant bacterial consortium or CSSRI's halomix microbial consortium is recommended for reclamation of sodic soil, higher cane and CCS yield of suru sugarcane as follows
 - Soil application of gypsum as per requirement
 - Drenching of VSI's halophilic-halotolerant bacterial consortium @ 20 lit. ha-1 or CSSRI's halomix microbial consortium @ 250 ml ha-1 in 500 lit. of water at the time of planting.
 - Application of 20 t FYM, 250 kg N, 115 kg P₂O₅ and 115 kg K₂O per hectare.

Agril. Engineering

Farm Machinery & Power

47. Ridger having concave shaped mouldboard is recommended for formation of wider and deeper furrows in field.

Agril. Process Engineering

48. The following process is recommended for the preparation of 'Phule Mixed Fruit Beverage Powder' from good quality mixed fruit juice powder:
- (1) Prepare the base juice blend using a specific ratio of 45% raw mango juice, 45% aonla juice, and 10% lemon juice to provide acceptable sensory qualities.
 - (2) Prepare mixed fruit juice powder by utilizing a 19% carrier combination of Maltodextrin (MD) and Gum Arabic (GA) in equal proportions using spray drying technique with an inlet temperature of 150°C and a feed rate of 62.5 mL/h to ensure maximum yield, solubility, and nutrient retention.
 - (3) Prepare a good-quality (taste) mixed fruit effervescent beverage, a blend of 4.8 g spray-dried mixed fruit powder, 7 g citric acid, 7 g sodium bicarbonate, 0.2 g stevia powder, and 0.5 g black salt should be prepared and dissolved in 1L of water.
 - (4) Utilize 100 micron two-ply (LDPE: ALP) packaging material to ensure the storage stability of the mixed fruit juice powder for up to six months and the effervescent RTS powder formulation for up to three months.
49. The following process is recommended for the preparation of 'Phule Premixed Tamarind Beverage Powder' (R.T.S. Premix) from good quality foam-mat dried tamarind powder:
- (1) Prepare good quality foam mat dried tamarind powder with acceptable physicochemical, antioxidant, and reconstitution properties, blend tamarind pulp with 5.0% Maltodextrin as a foaming agent and 4.0% Hydroxypropyl Methylcellulose as a stabilizer, generate foam by aerating the mixture with a compressor and whipping it for 10 minutes using a mixer, spread the foam in a 1.0 cm thick layer on a tray, dry it in a tray dryer at 55°C until a 5% moisture content, and grind it into a powder using a grinder.
 - (2) Prepare a good-quality RTS, a premix of 27.5 g foam mat dried tamarind powder, 0.25g citric acid, 160g sugar, 100 mg black salt and 300 mg cumin powder dissolved in 1L of water.
50. Preparation of Jamun leaf powder with maximum phenolic content and flowability is recommended to cut the leaves into pieces, dry in a tray dryer at 55°C until the moisture content reaches below 6%, grind it into a powder, pack the powder in 51-micron LDPE bags and store at room temperature (27±2°C) up to 6 months, making this nutrient-rich powder suitable for further value addition such as direct consumption with warm water, brewing as a herbal tea, or processing into therapeutic tablet forms etc.
51. Preparation of good quality Jamun leaf powder incorporated cookies using 940 g wheat flour, 60 g Jamun leaf powder, 400 g jaggery, 500 g ghee, 245 mL water, 5 g sodium bicarbonate and 5 g ammonium bicarbonate is recommended to store in 51-micron LDPE bags at room temperature (27±2°C) upto 90 days.

Irrigation & Drainage Engineering

52. The crop coefficients given in the following table are recommended for the estimation of water requirement of garlic crop.

Crop Week	Kc	Crop Week	Kc
1	0.40	11	1.08
2	0.50	12	1.09
3	0.58	13	1.07
4	0.65	14	1.02
5	0.72	15	0.95

6	0.79	16	0.85
7	0.86	17	0.74
8	0.93	18	0.63
9	0.99	19	0.54
10	1.05	20	0.50

Alternatively, following equation is recommended.

$$K_{ct} = 19.104(t/T)^5 - 42.671(t/T)^4 + 30.471(t/T)^3 - 9.4373(t/T)^2 + 2.6968(t/T) + 0.3305$$

Where,

K_{ct} = Crop Coefficient on t^{th} day,

t = Number of days since sowing,

T = Total Crop Period

53. The crop coefficients given in the following table are recommended for the estimation of water requirement of Okra crop.

Crop Week	Kc
1	0.65
2	0.78
3	0.88
4	0.99
5	1.10
6	1.20
7	1.30
8	1.37
9	1.39
10	1.35
11	1.24
12	1.06
13	0.83

Alternatively, following equation is recommended.

$$K_{ct} = 10.75(t/T)^5 - 28.72(t/T)^4 + 23.95(t/T)^3 - 8.41(t/T)^2 + 2.623(t/T) + 0.547$$

Where,

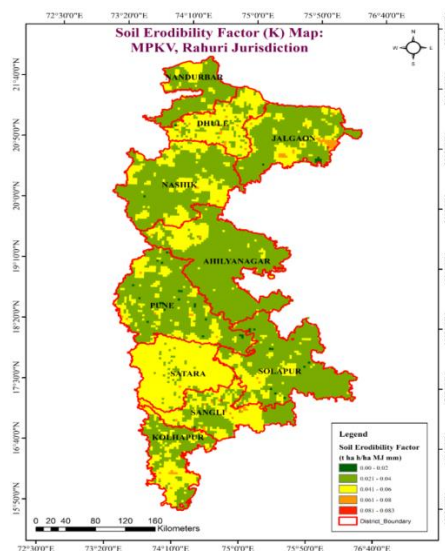
K_{ct} = Crop coefficient on t^{th} day,

t = Number of days since sowing,

T = Total crop Period, days

Digital Agriculture

54. Geographical Information System (GIS) based Soil Erodibility Factor map for Mahatma Phule Krishi Vidyapeeth, Rahuri (Western Maharashtra) jurisdiction is recommended for estimation of soil erosion.



55. IoT based **“Phule Runoff Measuring device”** is recommended for accurate, real – time runoff measurement.
56. Sensor based **“Phule Suspended Sediment Measuring Device”** is recommended for accurate, real – time measurement of suspended sediment concentration.
57. The refined location constants K, a, b and d in rainfall intensity, frequency and duration relationship for Solapur district have been recommended as 4.52, 0.2032, 0.55 and 0.9411 respectively.

$$I = \frac{K T^a}{(t + b)^d}$$

Where, I = rainfall intensity, cm/hr; T = return period, yr; t = duration, h

58. The nomograph developed for Solapur district is recommended for quick and easy estimation of rainfall intensity required for design of water harvesting structures.

Digital Agriculture- 03 (02 Merge in NRM)

59. **“Phule microclimate monitoring and control system”** is recommended for efficient management of livestock shed to identify stress in livestock by environmental factors (temperature, humidity and air quality index).
60. **“Phule Garud”** mobile application is recommended for accurate breed recognition, body weight estimation and body condition score (BCS) assessment of cows.
61. It is recommended to use tractor mounted **‘Phule variable rate fertilizer application system’** for automatic site-specific application of nitrogen (on the go sensing) on the bed planted/sown crops for saving of nutrients.
62. Drone spraying protocol is recommended for the effective control of pod borer complex in pigeonpea as following:
 - (1) Operate Hexa-copter spraying drone (10 L capacity) at 2 m height above crop canopy with 3.5 m/s forward speed and 4 m swath in autonomous mode. (Volume Mean Diameter (VMD) 171-231 µm and droplet density 120-230 per cm²).
 - (2) First spraying of insecticide, Emamectin Benzoate 5% SG @ 88 g/ 10 L water per acre and second spraying of insecticide, Chlorantraniliprole 18.5% SC @ 60 ml/ 10 L water per acre at an interval of 15 days after the appearance of incidence of pod borer complex (pod borer or pod fly).
63. Drone spraying protocol is recommended for the effective control of gram pod borer in chickpea as following:

- (1) Operate Hexa-copter spraying drone (10 L capacity) at 2 m height above crop canopy with 3.5 m/s forward speed and 4 m swath in autonomous mode.
- (2) One spray of Chlorantraniliprole 18.5% SC @ 50 ml/ 10 L water per acre after the appearance of incidence of gram pod borer.

Social Sciences

Agricultural Extension Education

64. The economic analysis revealed that the Phule Vikram variety of chickpea developed by Mahatma Phule Krishi Vidyapeeth has resulted in 30.30 per cent increase in yield and 45.15 per cent increase in economic return of farmers due to adoption of full technology package viz., 1. MPKV released variety Phule Vikram; 2. Seed treatment with biofertilizers; 3. Sowing by BBF planter; 4. Use of Phule Micrograde II; 5. Interculture operations with cycle hoe; 6. Pre-emergence spray of pendimethalin 30 % EC for weed control; 7. Integrated pest and disease management and 8. Irrigation with sprinkler irrigation system. Thus, it is recommended to adopt the full technology package for more economic returns from chickpea crop.
65. Climate change adversely affects bee ecology by increasing pest and disease incidence. Therefore, it is recommended that focused research on climate-resilient apicultural practices, along with scientific beekeeping techniques is required. Also, coordinated capacity building efforts through trainings, workshops and exposure visits should be made in major beekeeping regions to promote diversified honeybee products so as to realize the full potential of apiculture as a sustainable enterprise.
66. Mahatma Phule Krishi Vidyapeeth released soybean varieties have demonstrated promising field performance with area as well as productivity in study area with 51. 25 per cent respondent using MPKV released soybean varieties; on over 61.36 per cent area with average yield of 24.23 qtl/ha, their recognition among farmers' remains limited due to indirect marketing channels and insufficient attribution, as most of these seeds are marketed by *Mahabeej*, private companies and FPO's. Hence it is necessary to take steps towards seeking attribution to enhance the visibility, accessibility and adoption of its soybean varieties. It is recommended that the agriculture university should enhance the visibility and adoption of university released soybean varieties by ensuring clear attribution through logos or labels on seed bags marketed by *Mahabeej* or other seed companies.
67. The study observed that the Forage Technology Demonstrations (FTD's) has brought significant positive changes in terms of increase in knowledge, adoption, reduction in cost of cultivation and increased availability of per day green fodder among the beneficiary farmers. Therefore, it is recommended that farmers shall adopt MPKV developed Oat and Berseem fodder cultivation technology in Rabi season for cost efficient per day green fodder yield.
68. The use of breeding bucks and management practices provided by Goat Project, MPKV, Rahuri had positive and significant impact on goat genetic improvement and livelihoods of the beneficiaries. Therefore, it is recommended that the project be scaled up for goat genetic improvement and livelihoods enhancement of farmers.
69. The acid lime growers climate smart agriculture (CSA) practice adoption behaviour is highly reactive as evident from their adoption of climate smart practices related to the management of climate extremes is very high (0.72), whereas, adoption of proactive practices such as 'nutrient management' (0.38) and 'disease and pest management' (0.49) is relatively low. Moreover, nearly 88 per cent of acid lime growers fall into the low to medium categories of

climate smart agriculture practices followed. Therefore, it is recommended that the agricultural extension agencies shall focus more on sustainability (such as nutrient management) and risk management (such as management of climate extremes) aspects of climate smart agriculture.

Social Sciences

Agricultural Economics

70. The parity between farm harvest prices (FHP) and input prices falling below unity are eroding farmers' real purchasing power resulting in economical vulnerability of soybean farmers. Therefore, to strengthen the parity between FHP and input prices and economic resilience, it is recommended to promote cost-effective technologies of MPKV, Rahuri, ensure effective implementation of the Minimum Support Price (MSP) and establish stronger price support mechanisms.
71. Maharashtra, second best of the prime mango pulp exporting states of India, has shown stagnant growth in both quantity and value. To enable efficiency and sustained competitiveness in global markets and to secure leadership through consistent supply and drive growth in exports, it is recommended that the Maharashtra Government and Agriculture Department should establish dedicated mango processing clusters with strong backward linkages.
72. Based on the price forecasting of sorghum and pearl millet in major markets of Maharashtra using 20 years data (2004–05 to 2024–25) with ARIMA model, sorghum prices were observed maximum during November–December (Barshi, Jamkhed and Jalna). Similarly, pearl millet prices were found maximum during March to May (Pune, Chalisgaon, Malegaon and Chhatrapati Sambhajinagar). Therefore, it is recommended that farmers plan to sell sorghum during November–December and pearl millet during March to May for better prices.
73. Farmers in Maharashtra earned gross returns of Rs.12,869 crores and net returns of Rs.2,294 crores from the cultivation of *rabi* sorghum varieties Phule Vasudha, Phule Revati, and Phule Suchitra released by MPKV, Rahuri, over 16-years period (2009-10 to 2024-25). The investment in *rabi* sorghum research and extension revealed an Internal Rate of Return (IRR) of 25 per cent, therefore it is recommended that the government should provide substantial funds for research and extension in *rabi* sorghum.
74. The farmers in Maharashtra earned gross and net returns of Rs. 11,095 crores and Rs. 558 crores from soybean variety Phule Sangam (KDS-726) released by MPKV, Rahuri during 8 years (2016-17 to 2023-24). Whereas, gross and net returns of Rs. 14,849 crores and Rs.1,059 crores from soybean variety Phule Kimaya (KDS-753) during 7 years (2017-18 to 2023-24). An investment in soybean research and extension revealed 20 per cent Internal Rate of Return (IRR). Therefore, it is recommended that the government should provide the substantial funds for research and extension in soybean.
75. As per projections based on the ARIMA model, Maharashtra is likely to face a significant shortage of food grains by 2050. The deficit is expected to be particularly high in paddy (8.57 million tonnes), at nearly three times the projected state production, and in wheat (7.22 million tonnes) and jowar (0.91 million tonnes), at about four times the projected production. Therefore, it is recommended that the State Government increase the production of these cereals by enhancing productivity through the adoption of technologies developed by

agricultural universities, as well as by implementing region-specific crop planning and encouraging farmers to expand the area under these crops.

76. Banana growers can earn higher profits by producing and selling value-added products instead of selling raw bananas. Banana chips and banana powder yields higher incremental benefit–cost ratios of 2.05 and 2.38, respectively; therefore, it is recommended that farmers should encourage to undertake the production and marketing of these value-added products.
77. The scientific stationary beekeeping unit (21 hives of *Apis cerana indica*) in Western Maharashtra is an economically viable cottage venture with an average annual net profit of Rs.36,842 and benefit-cost ratio of 1.98 from honey production during the year 2024-25. Therefore, it is recommended that for honey production, households in forest-adjacent areas should adopt scientific beekeeping as a commercial enterprise to ensure sustainable income and enhanced livelihood security.

Biotic and Abiotic Stress (2)

78. Cotton genotypes AKH 2013-3 and RAH 1076 are recommended as resistant donors for jassid, based on low infestation of jassid, morphological traits and biochemical parameters.
