

# Research Recommendations Released during 2022 by Mahatma Phule Krishi Vidyapeeth, Rahuri

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## I Natural Resource Management

1. The following regression equation based on weather parameters for forewarning (prior to one week) on aphid infestation in wheat crop is recommended for the western zone of Maharashtra.

### Equation:

No. of Aphids /shoot/plant =  $200.70 - 15.65 \times T_{\max} + 3.12 \times RH-1 + 38.25 \times WS - 2.91 \times Epan$ .

Where, Aphids = Aphid population/shoot/plant (in equation),

$T_{\max}$  = Maximum temperature ( $^{\circ}C$ ),

RH-1 = Morning relative humidity (%),

WS = Wind Speed (km/hr),

Epan = Pan evaporation (mm).

2. The following regression equation based on weather parameters for forewarning (prior to one week) on leaf miner infestation in citrus is recommended for the scarcity zone of Maharashtra.

### Equation:

Leaf miner (No. of mines /plant) =  $213.13 + 0.15 \times T_{\min} - 2.11 \times RH-2 + 0.23 \times RF - 10.41 \times BSS$

Where, Leaf miner = Leaf mines (in equation),

$T_{\min}$  = Minimum temperature ( $^{\circ}C$ ),

RH-2 = Afternoon relative humidity (%).

RF = Rainfall (mm),

BSS = Bright Sunshine Hrs

3. The following regression equation based on weather parameters for forewarning (prior to one week) on aphid infestation in potato crop is recommended for the western zone of Maharashtra.

### Equation:

Aphid (No. of Aphids /leaf/plant) =  $659.13 - 89.32 \times T_{\max} + 10.74 \times T_{\min} + 20.76 \times RH-1 + 61.78 \times WS$ .

Where, Aphid = Aphid population/leaf/plant (in equation),

$T_{\max}$  = Maximum temperature ( $^{\circ}C$ ),

$T_{\min}$  = Minimum temperature ( $^{\circ}C$ ),

RH-1 = Morning relative humidity (%),

WS = Wind Speed (km/hr).

4. Application of 25% of the recommended dose of N through urban compost one week before sowing/ planting and remaining 75% N through urea along with recommended dose of  $P_2O_5$  and  $K_2O$  to Bt.-cotton, pearl millet, maize, wheat, maize fodder, sorghum fodder, pigeonpea, chickpea, groundnut, cabbage, onion and okra is recommended for increase in yield, plant nutrients uptake and monetary returns in irrigated shallow to deep black soils of Western Maharashtra.

Note:- Before use of urban compost it should be analyzed in the laboratories for heavy metals content and heavy metal content should be below critical limits given by fertilizer control order.

5. Application of 75% RDF (18.75 kg N/ha+ 37.50 kg  $P_2O_5$ /ha ) at the time of sowing with 2% foliar spray of water soluble fertilizer (19:19:19) at 45 and 60 DAS is recommended to increase the yield and monetary returns of summer groundnut in Western Maharashtra.
6. The application of FYM 10 t/ha along with N,  $P_2O_5$  and  $K_2O$  @ 50:40:30 kg/ha in which half dose of N and full dose of  $P_2O_5$  and  $K_2O$  at the time of transplanting and remaining half dose of N at 30 days after transplanting is recommended for obtaining the highest marketable dry herbage yield and monetary return of medicinal Tulsi in medium black soils of Western Maharashtra.
7. Application of 10 t FYM  $ha^{-1}$  one month before transplanting and 60 kg N, 30 kg  $P_2O_5$ , 4.2 kg Zn (20 kg zinc sulphate) and 0.66 kg B (6 kg borax)  $ha^{-1}$  through briquettes applied with 5 g guar gum per kg briquettes alongwith 50 kg  $K_2O$   $ha^{-1}$  at the time of transplanting to lowland paddy is recommended for higher yield and net returns in zinc and boron deficient soils of Western Ghat Zone of Maharashtra.
8. Application of recommended dose of N and  $P_2O_5$  (25:50 kg  $ha^{-1}$ ) alongwith 5 t FYM and 2% foliar spray of Diammonium phosphate (DAP) at 50% pod setting stage is recommended for chickpea grown on medium deep black soils in scarcity zone of Maharashtra for higher yield and monetary returns.
9. Application of recommended dose of N and  $P_2O_5$  (50: 25 kg  $ha^{-1}$ ) alongwith three foliar sprays of 2% water soluble fertilizer 19:19:19 at rosette stage (25-30 DAS), bud initiation stage (45-50 DAS) and flowering stage (55-60 DAS) is recommended for safflower grown on medium deep black soils of scarcity zone of Maharashtra at terminal drought condition for higher yield and monetary returns.

10. Application of recommended dose of N and P<sub>2</sub>O<sub>5</sub> (50:25 kg ha<sup>-1</sup>) at sowing along with sulphur 40 kg ha<sup>-1</sup> incubated in one tone FYM 15 days before sowing is recommended for safflower grown on medium deep black sulphur deficient soils in scarcity zone of Maharashtra for higher yield and monetary returns.
11. *In situ* green manuring with black gram during *kharif* season followed by seed treatment of *Azotobactor* and *Azospirillum* @ 25 g kg<sup>-1</sup> with 50% RDN (25 kg), full dose of P<sub>2</sub>O<sub>5</sub> (25kg) and K<sub>2</sub>O (25kg) pre hectare at the time of sowing is recommend for *rabi* sunflower grown on medium deep black soil in scarcity zone of Maharashtra for getting higher grain yield, economic returns with better soil health.
12. Application of 40kg ha<sup>-1</sup> sulphur with FYM 2.5 ton 15 days before sowing with recommended dose of N:P<sub>2</sub>O<sub>5</sub>:K (25:50:0)kg ha<sup>-1</sup> is recommended for linseed grown on medium deep black sulphur deficit soil in scarcity zone of Maharashtra for higher yield and monetary returns.
13. Groundnut + Pigeonpea (4:2) intercropping system and Groundnut- Chickpea cropping systems are recommended to increase the yield and monetary returns of *kharif* groundnut in assured rainfall zone of north Maharashtra.
14. Application of 100% RDF(25 kg N/ha+ 50 kg P<sub>2</sub>O<sub>5</sub>/ha) to soil and seed treatment with bio-grow formulation @ 50 ml/10 kg seed along with 200 ml water at the time of sowing is recommended to increase the yield and economic returns of summer groundnut in Western Maharashtra.
15. Sowing of Phule Morana / Phule Warana groundnut variety with 45 x 10 cm<sup>2</sup> spacing and seed rate 67 kg ha<sup>-1</sup> is recommended to increase the yield and economic returns of *kharif* groundnut in assured rainfall zone of north Maharashtra.
16. Drip fertigation with 80% recommended dose (80:40:40 NPK kg ha<sup>-1</sup>) of water soluble fertilizers in 12 weekly splits as per following schedule is recommended for higher yield, efficient water, nutrient use and higher economical returns from summer okra cultivated in medium deep soils of western Maharashtra.

Days after sowing	Nitrogen (N)		Phosphorus (P)		Potassium (K)	
	%	kg	%	kg	%	kg
1-21 days (3 weeks)	25	20	20	08	15	06
22-42 days (3 weeks)	35	28	40	16	25	10
43-63 days (3 weeks)	25	20	25	10	30	12
64-84 days (3 weeks)	15	12	15	06	30	12
<b>Total</b>	<b>100</b>	<b>80</b>	<b>100</b>	<b>40</b>	<b>100</b>	<b>40</b>

17. In medium deep soils of western Maharashtra for higher green forage yield and net monetary returns of irrigated marvel following fertilizer application is recommended.

- Application of 10 t FYM ha<sup>-1</sup> before planting.
- Application of fertilizer dose 160:40:20 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> yr<sup>-1</sup>.
- Full phosphorus and potassium at planting and every year and nitrogen in eight equal split of 20 kg ha<sup>-1</sup> at planting and after every cut of green forage at an interval of 45 days should be applied.

18. Drip irrigation method and withdrawal of irrigation at 100 days after transplanting of onion is recommended for higher yield, efficient water use and low storage losses of onion bulb cultivated under western Maharashtra.

19. Drip fertigation with 80% recommended dose (96:48:48 NPK kg ha<sup>-1</sup>) of water soluble fertilizers in 15 weekly splits as per following schedule is recommended for higher yield, efficient water, nutrient use and higher economical returns from onion seed production in medium deep soils of western Maharashtra.

Days after Planting	Nitrogen (N)		Phosphorus (P)		Potassium (K)	
	%	kg	%	kg	%	kg
1-28 days (4weeks)	25	24	30	14.4	15	7.2
29-56days (4weeks)	30	28.8	35	16.8	35	16.8
57-84 days (4weeks)	30	28.8	25	12	30	14.4
85-105 days (3weeks)	15	14.4	10	4.8	20	9.6
<b>Total</b>	<b>100</b>	<b>96</b>	<b>100</b>	<b>48</b>	<b>100</b>	<b>48</b>

20. The pre emergence application of 1.5 liter 30.7 % EC pretilachlor per hectare within 2 to 3 days after sowing and post emergence application of 0.2 liter 10% SC bispyribac sodium per hectare at 25 days after sowing in 500 liters of water is recommended for effective management of weeds in drilled paddy of sub montane zone of Maharashtra.

21. The pre emergence application of 100 g 10% WP pyrazosulfuron ethyl per hectare in 500 liters of water at 3-5 days after transplanting and one weeding after 45 days is recommended for effective management of weeds in transplanted paddy of sub montane zone of Maharashtra.

22. Cultivation of minimum tillage based chickpea after *kharif* transplanted paddy under receding soil moisture conditions is recommended to obtain sustainable yield and monetary returns as well as to maintain soil fertility for submontane zone of Maharashtra.

### III Horticulture

23. It is recommended that old, senile, high density (5x5m) planted mango orchard Cv. Kesar should be headed at 1.5 m height from ground level for higher fruit yield during November - December in Maharashtra.
24. Foliar application of silicic acid @ 2.0 ml /L to *kharif* onion at nursery stage after 30 days of seed sowing and remaining 3 sprays at 20, 40 and 60 days after transplanting is recommended alongwith recommended dose of fertilizers (100:50:50 Kg N:P:K ha<sup>-1</sup> + 20 t ha<sup>-1</sup> FYM) for increasing bulb yield and monetary returns.

### V Basic Sciences, Food Science and Technology

25. Delayed harvested fodder of hybrid napier cv. Phule Gunwant before 70 days treated with 2% jaggery is recommended for preparation of good quality silage.
26. Based on juice extractability and biochemical analysis of juice for keeping quality during 2hr dwell time period, sugarcane genotype PDN-15012 is specially recommended for *Rasvanti* purpose. The shelf life of this juice can be further increased upto 5 days with the application of 85 °C heat treatment 10 min + ascorbic acid @80 mg 100 ml<sup>-1</sup> and upto 15 days by application of 85 °C heat treatment for 10 min + KMS @ 250ppm.
27. SSR markers, Satt197<sub>179bp</sub> and Satt063<sub>116bp</sub> are recommended to accelerate breeding of long juvenile soybean varieties capable of withstanding climatic change.
28. It is recommended to prepare good quality cookies having various medicinal properties and high fiber content with Shatavari 6 % or Ashwagandha 6 % or Pudina 4 % or Aonla 5 % or Behada 5 %, medicinal powder + Maida 1000 g, 500 g sugar, 500 g fat, 5 g ammonium bicarbonate and 5 g sodium bicarbonate.
29. It is recommended to prepare good quality cookies and biscuits with high fiber content from *kodo* millet flour 500 g and 500 g maida, 500 g sugar, 500 g fat, 5 g ammonium bicarbonate and 5 g sodium bicarbonate.

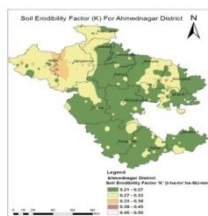
### VI Plant Protection

30. Seed biopriming with MPKV liquied *Aceotobacter* and PSB cultures @ 300 ml each/10 kg seed in 10 lit. Water for 12 hrs before sowing and application of 50 % recommended N (25 kg/ha). 75% P<sub>2</sub>O<sub>5</sub> (38 kg/ha) and 100% (25kg/ha) at the time of sowing is recommended for getting higher grain yield. Stover yield and monetary returns from *rabi* sorghum under dryland conditions in scarcity zone of Maharashtra.

31. The seedling root dipping treatment of *kharif* onion with silicic acid @ 2.0 ml/l for 5 minutes at transplanting followed by subsequent three foliar sprays of silicic acid at 20, 40 and 60 days after transplanting is recommended for effective management of purple blotch disease and for getting maximum yield of onion.

## VII Agril. Engineering

32. The coefficient and exponent of Modified Universal Soil Loss Equation (MUSLE) as shown by  $K_1$  and  $m$  in following equation,  $S_Y = K_1(Qq_p)^m KLSCP$ , may be changed to 0.039 and 0.135 for uniform slope; 0.076 and 0.30 for Convex-Concave slope; and 35.49 and 1.32 for Concave-Convex slope instead of 11.8 and 0.56 as proposed originally based on data from United States of America.
33. The taluka wise soil erodibility map is recommended for estimating soil loss in Ahmednagar district of Maharashtra.



34. The refined location constants  $K$ ,  $a$ ,  $b$  and  $d$  in rainfall intensity-frequency-duration relationship for Solapur district have been recommended as 4.57, 0.1934, 0.40 and 0.9187 respectively.
35. Planting of seedlings of *suru* sugarcane at distance of 45 cm in 5 feet furrows under sub surface drip irrigation scheduled at 80% ETc every alternate day with 80% RDF (200:92:92, N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>) through water soluble fertilizers in 30 weekly splits is recommended for medium deep black soil of Western Maharashtra for higher monetary returns.
36. The tabular information and maps developed in Geographical Information System (GIS) by Mahatma Phule Krishi Vidyapeeth for tahsils of western Maharashtra are recommended for estimating weekly water and irrigation requirement of groundnut and brinjal crop at specific locations by surface and drip methods.

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

Week since sowing	Kc values
1	0.56
2	0.61
3	0.68
4	0.77
5	0.87
6	0.97
7	1.05
8	1.10
9	1.12
10	1.09
11	1.01
12	0.90
13	0.76
14	0.62
15	0.50
16	0.45

Alternatively following equation is recommended

$$Kc = 10.84\left(\frac{t}{T}\right)^5 - 17.063\left(\frac{t}{T}\right)^4 + 2.3949\left(\frac{t}{T}\right)^3 + 3.4911\left(\frac{t}{T}\right)^2 + 0.2369\left(\frac{t}{T}\right) + 0.5482$$

Where,

Kc<sub>t</sub>= crop coefficient on t<sup>th</sup> day

t = number of days since sowing

T = total crop period

38. The FAO crop coefficients modified for Rahuri region given in following table are recommended for the estimation of water requirement of cauliflower, garlic, watermelon and cucumber.

Cauliflower		Garlic		Watermelon		Cucumber	
WAP	Modified Kc	WSS	Modified Kc	WSS	Modified Kc	WSS	Modified Kc
1	0.72	1	0.73	1	0.78	1	0.77
2	0.75	2	0.74	2	0.80	2	0.78
3	0.78	3	0.76	3	0.83	3	0.81
4	0.82	4	0.77	4	0.87	4	0.84
5	0.86	5	0.79	5	0.90	5	0.87
6	0.90	6	0.81	6	0.94	6	0.90
7	0.94	7	0.83	7	0.98	7	0.94
8	0.98	8	0.85	8	1.01	8	0.98
9	1.01	9	0.88	9	1.03	9	1.01
10	1.03	10	0.90	10	1.04	10	1.03
11	1.04	11	0.93	11	1.03	11	1.05
12	1.04	12	0.95	12	1.01	12	1.07
13	1.02	13	0.98	13	0.98	13	1.07
14	0.98	14	0.99	14	0.94	14	1.06
		15	1.00	15	0.89	15	1.04
		16	0.99	16	0.84	16	1.01
		17	0.97			17	0.97
		18	0.93			18	0.92
		19	0.86			19	0.87
		20	0.76				

(WAP- Week after planting, WSS- Week since sowing, Kc- Crop coefficient)

Alternatively, following equations are recommended

Crop	Polynomial Equation
Cauliflower	$Kc_t = 3.4446\left(\frac{t}{T}\right)^5 - 8.7683\left(\frac{t}{T}\right)^4 + 6.4669\left(\frac{t}{T}\right)^3 - 1.4417\left(\frac{t}{T}\right)^2 + 0.5998\left(\frac{t}{T}\right) + 0.6483$
Garlic	$Kc_t = -2.6466\left(\frac{t}{T}\right)^4 + 3.1089\left(\frac{t}{T}\right)^3 - 0.8255\left(\frac{t}{T}\right)^2 + 0.3583\left(\frac{t}{T}\right) + 0.718$
Watermelon	$Kc_t = 3.0269\left(\frac{t}{T}\right)^5 - 5.77\left(\frac{t}{T}\right)^4 + 2.0281\left(\frac{t}{T}\right)^3 + 0.4976\left(\frac{t}{T}\right)^2 + 0.2706\left(\frac{t}{T}\right) + 0.7709$
Cucumber	$Kc_t = 1.4224\left(\frac{t}{T}\right)^5 - 2.3807\left(\frac{t}{T}\right)^4 - 0.6571\left(\frac{t}{T}\right)^3 + 1.5681\left(\frac{t}{T}\right)^2 + 0.1258\left(\frac{t}{T}\right) + 0.764$

t = number of days since sowing,

T = total crop period



39. “Phule Fertigation Scheduler” mobile application developed by Mahatma Phule Krishi Vidyapeeth is recommended for deciding the quantity of fertilizers to be applied and the duration of its application for different crops.
40. The following equation expressed as ratio of days after planting to total crop period ( $t/T$ ) is recommended for estimating Normalized Difference Vegetative Index (NDVI) values of seasonal (Suru) sugarcane grown under water deficit free conditions.

$$NDVI_t = -0.436 \left(\frac{t}{T}\right)^3 - 0.716 \left(\frac{t}{T}\right)^2 + 1.775 \left(\frac{t}{T}\right) + 0.198$$

The following equations are recommended for estimation of crop coefficients from NDVI values useful in real time water requirement of seasonal (Suru) sugarcane.

Growth Phase (50-294 Days since planting)

$$Kc_t = -3.525 (NDVI_t)^2 + 6.749 (NDVI_t) - 1.995$$

Decline phase (295-365 Days since planting)

$$Kc_t = 12.25 (NDVI_t)^2 - 16.79 (NDVI_t) + 6.056$$

$Kc_t$  is Crop Coefficient on  $t^{\text{th}}$  day

41. The web and mobile-based applications "Spatial ETr" developed by Mahatma Phule Krishi Vidyapeeth are recommended for the real time and location specific estimation of evapotranspiration for irrigation scheduling.
42. It is recommended to use mobile application “Phule – SANMAN” for survey of present mechanization status and dissemination of information on agricultural machinery as per crop, operation and type of farm machinery.
43. It is recommended to use mobile application “Phule – SAM” for connecting farmers with service providers for agricultural mechanization services like custom hiring, repairs and sales centres of farm machinery.

## **VIII Social Science**

44. In a research project on “Impact of Mushroom training”, a C:B ratio of 4.44 for fresh Oyster mushroom production and between 1.25 to 1.71 for processed mushroom products indicated mushroom production and processing as a good source of livelihood for the small and marginal farmers as well as landless people. Also, 54 per cent of the trainees suggested increasing the duration of training. Two-third of the respondents closed the mushroom production enterprises after facing major problems of lack of demand in the market (84 per cent) and lack of awareness among the people (87 per cent) about mushroom. Hence, it is

recommended that the State Department of Agriculture and Krishi Vidnyan Kendras should create awareness and promote this enterprise among small, marginal farmers and landless people and ICAR and MPKV, Rahuri should increase the duration of mushroom production training from the present one day training. It is also recommended to create strong forward linkages with market and processing projects, create awareness among people about health benefits of mushroom and Mushroom Growers Association should be established with help of State Agriculture and allied development departments, non- government organizations and Krishi Vidnyan Kendra.

45. Research project on Group Farming indicated that groups under Group Farming Scheme were able to seek financial support for establishment of large investment projects which, otherwise, would not had been possible for individual small and marginal farmers. None of the group was following collective crop cultivation / livestock rearing as envisaged in the concept of group farming .It was also revealed that more than 80 per cent of the member farmers had stated the problems of difficulties in procurement of bank loans for groups and electricity supply for their group agro-processing projects being charged at industrial rates rather than agricultural rates. Therefore, it is recommended that the State Agriculture Department should encourage member farmers of Group Farming Scheme to undertake group cultivation / livestock rearing, promote group farming on large scale through success stories for empowering small and marginal farmers, modify certain criteria for easy disbursement of loans and provide electricity at agricultural rate rather than industrial rate to agro-processing projects.
46. Subsurface drainage system for reclamation of waterlogged saline-sodic medium to deep black soils is technically viable, economically feasible and socially acceptable but adoption of in situ green manuring and use of gypsum was found less, also at post reclamation stage, no significant difference was found in Yield and B:C ratio of the sugarcane at different lateral spacings (10 -15m, 16-20m & 21-30m). Hence it is recommended that, to avoid burden of high initial cost and excess drainage of water with closer lateral spacings; extension agencies (KVKs, SAUs & Agril. Department) should motivate farmers through group discussions and result demonstrations to adopt 21-30 m of lateral spacing and adoption of in situ green manuring and use of gypsum (5MT/ha ) for reclamation of waterlogged saline-sodic medium to deep black soils.

47. From the study on “Mitigation practices followed by maize growers to control fall armyworm pest” it is inferred that majority of the respondents were educated up to secondary to graduation level, had average extension contact and high level of exposure to mass media. They mostly rely only on chemical control of FAW and had low adoption of cultural, physical, biological methods. But for sustainable management of FAW in maize cultivation it is necessary to adopt the chemical methods along with cultural, physical and biological control methods. Therefore it is strongly recommended that, State Agricultural Department with the help of KVKs should promote and start Farmers Field School (FFS) for imparting knowledge, skills and increasing adoption of integrated management of fall armyworm.
48. The data pointed low knowledge and low adoption of the guava growers regarding training and pruning aspects in high density planting of guava (80 % and 85 %), rejuvenation technique (69 % and 75 %), fertilizer schedule (68 % and 83 %), plant protection particularly control of fruit fly and nematodes (58 % and 76 %) and post-harvest technology (52 % and 100 %), respectively. Hence, it is recommended that training programmes and demonstrations need to be organized on these aspects for guava growers by Department of Agriculture in coordination with State Agriculture Universities and Krishi Vigyan Kendras.
49. From the study it is concluded that, crop rotation against cotton crop ,intercropping and Installation of the tricho-card were a recommended practice to control pink bollworm. but from the study it was found that very few farmer follows Crop rotation (28 %), intercropping (51%) and installed tricho-card (5 %) and other bio-agents. Therefore, from the study it is suggested that Crop rotation, intercropping should promote and bio-pesticides should made available on large scale and at reasonable cost by KVKs and State Department of Agriculture.
50. The study observed dominance of few local traders (oligopoly) in lemon marketing as overwhelming majority of the kagzi lime grower sale their produce at village level through few local traders (90 %). Consequently, lemon growers face marketing constraints like low and fluctuating market prices (86 %) and delayed cash payment (74 % ). Therefore, to overcome these constraints it is recommended that lemon growers of this region shall market their produce through formation of lemon producers groups.

51. The farmers in Maharashtra earned gross economic returns of Rs 44957 Crores and net economic returns of Rs. 4686 Crores from Mahatma Phule Krishi Vidyapeeth, Rahuri released onion varieties (Baswant-780, N-2-4-1, N-53, Phule Safed, Phule Suvarna & Phule Samarth during the period of 18 years (2002-03 to 2019-20). It is revealed that an investment of one rupee in onion research and extension helps to generate income of Rs. 30 with 32 percent Internal Rate of Returns (IRR). Therefore, it is recommended that the substantial funds be provided for onion research and extension activities.
52. The increase of 11 and 14 per cent in employment, 27 and 29 per cent in the output, 34 and 28 percent in income levels while reduction of 7 and 10 per cent in the per quintal cost of cultivation in medium over low and high over medium adoption group, respectively was the result of adoption of recommended package of practices for black gram cultivation. For the cost reduction and output maximization, it is recommended that the farmers shall adopt the recommended package of practices.
53. The drip irrigation method increased the yield of sugarcane and cotton, respectively by 33 and 43 per cent, saved 41 and 44 per cent of water and 16 and 42 per cent of electric consumption per hectare with reduction in carbon emissions by 16 and 42 per cent per hectare, compared to conventional surface Irrigation method. Therefore, it is recommended to encourage the adoption of drip irrigation for climate smart agriculture on wider scale by the sugarcane and cotton cultivators.
54. The major importing countries of banana from India are UAE, Saudi Arabia, Bahrain and Nepal for the last ten years (2010-11 to 2019-20) contributing 73 per cent of total banana export, but the prices received from Kuwait, Qatar, Oman and Iran were Rs.42.14/kg and it's higher than Bahrain and Nepal (Rs. 21.63/kg). It is, therefore, recommended to increase the export of banana to Kuwait, Qatar, Oman and Iran by reducing the export of banana to Bahrain and Nepal in order to get higher returns.
55. Path analysis of turmeric yield contributing nutrient factors revealed major contribution of FYM (43%) followed by Nitrogen (26%). Therefore, it is recommended to apply fertilizers (as per the yield target equation) with FYM for achieving targeted yield.
56. For predicting export of Onion, Grapes, Banana, Mango and Pomegranate from India, it is recommended to use Holt's, Brown's exponential smoothing model, ARIMA (3,1,6), Holt's,

ARIMA (0,1,0), respectively and for export values, Brown's for Onion, Banana and Pomegranate, Holt's for Grapes and Mango be used.

**Resistant Source for Biotic and Abiotic stress**

57. Based on infestation of jassids, morphological and bio-chemical traits the cotton genotype AKH 2006-2 is identified as resistant source against jassid.
58. Based on plant physiological and biochemical parameters, *desi* chickpea varieties JSC 55 (RVG 202), JG 14 (ICCV 92944) and Vijay are recommended as potential donors for heat stress tolerance in the chickpea breeding programme.