# RESEARCH ACHIEVEMENTS
# &
# FUTURE RESEARCH PRIORITIES

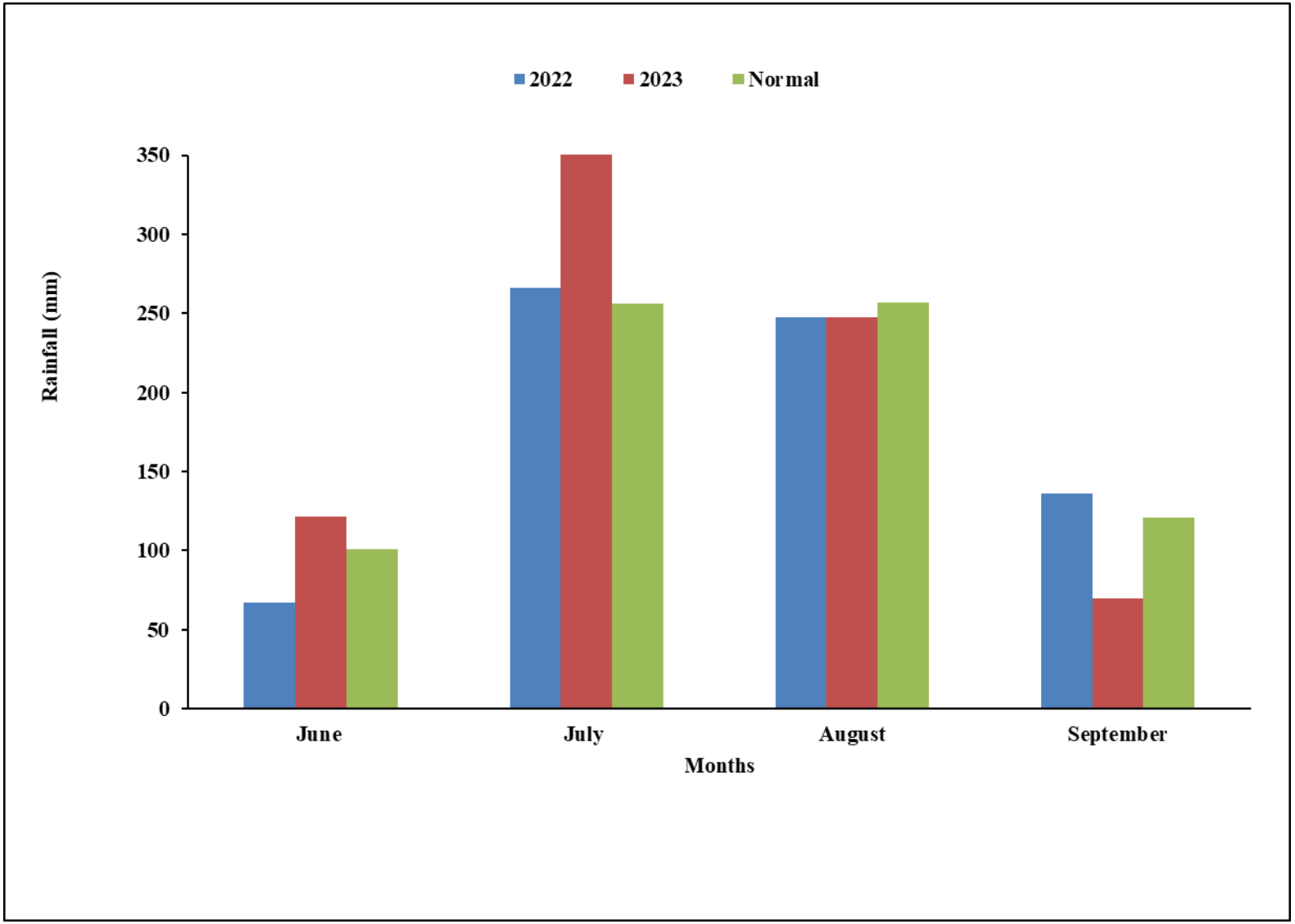

**Director of Research**

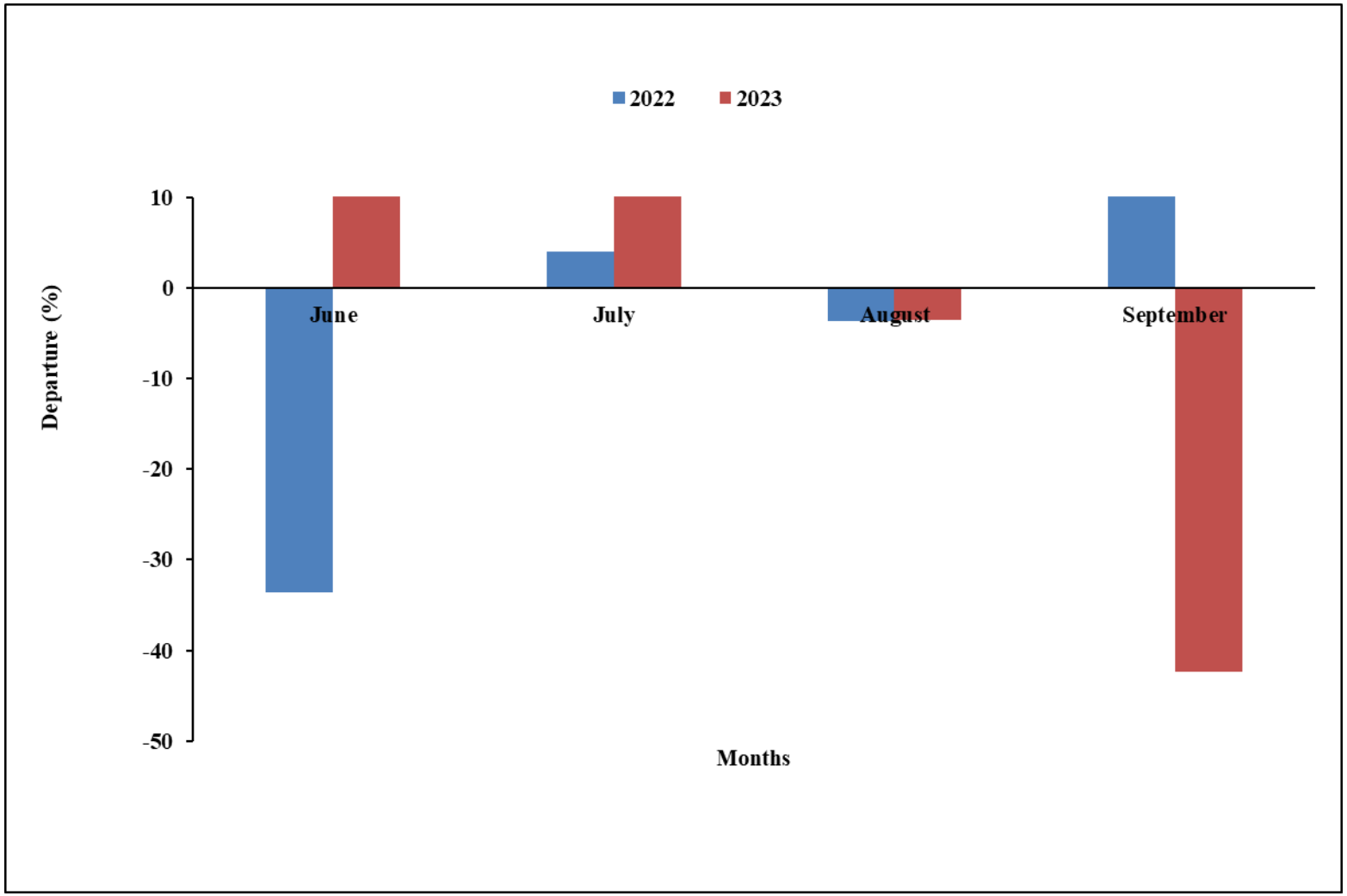
**Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya**

**Palampur – 176062 (H.P.)**

# Monthly rainfall during Kharif, 2023 in Himachal Pradesh as compared to Kharif, 2022

| Month | June | July | August | September | Seasonal total |
|---|---|---|---|---|---|
| Actual (mm) | | | | | |
| 2022 | 67.2 | 266 | 247.4 | 135.8 | 716.4 |
| 2023 | 121.7 | 437.5 | 247.6 | 69.6 | 876.4 |
| Normal | 101.1 | 255.9 | 256.8 | 120.6 | 734.4 |
| Departure (%) from normal | | | | | |
| 2022 | -34 | 4 | -4 | 13 | -2 |
| 2023 | 20 | 71 | -4 | -42 | 19 |

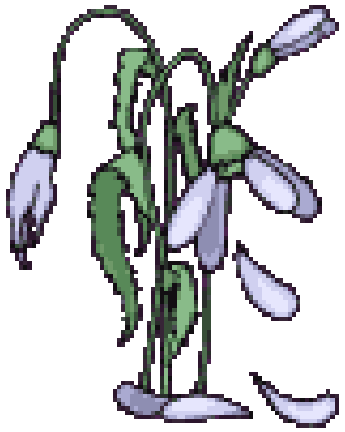

2022
2023
Normal
350
300
250
200
150
100
50
0
Rainfall (mm)
June
July
August
September
Months


2022
2023
10
0
-10
-20
-30
-40
-50
Departure (%)
June
July
August
September
Months

# ☞Research Programme Areas

- ✓Crop Improvement
- ✓Crop Production
- ✓Crop Protection
- ✓Protected Cultivation
- ✓Organic and Natural Farming

# RESEARCH HIGHLIGHTS



# ☞Crop Varieties Notified (CVRC)

## Him Palam Dhan 3 (HPR 2865)

- ✓Suitable for low Elevated Hills of HP and Uttrakhand
- ✓Possesses long bold grains; Average yield 38-40 q/ha
- ✓Moderately resistant to leaf blast

## Him Palam Dhan 4 (HPR 3201)

- ✓Suitable for entire HP and Uttrakhand
- ✓Possesses long slender grains; Average yield 40-45 q/ha
- ✓Moderately resistant to leaf blast

# ☞Crop Varieties Notified (CVRC)

## Him Palam Maize Composite 1 (L 315)


- ✓ Suitable for mid and high hills of the state; Maturity 100-102 days
- ✓ Average yield 60-62 q/ha
- ✓ Resistant to lodging and diseases (MLB) & moderately resistant to banded leaf and sheath blight

## Him Palam Maize Composite 2 (L 316)


- ✓ Himachal Pradesh; Union Territories of Jammu & Kashmir; Uttarakhand and North East Hills
- ✓ Medium maturing; Average yield of 65.65 q/ha.
- ✓ Moderately resistant to turcicum leaf blight, bacterial stalk rot and stem borer.

## Him Palam Soya-1 (Himso-1689)

- ✓ Central Zone of India comprising the states of Madhya Pradesh, Bundelkhand region of UP, Rajasthan, Gujarat and Marathwada and Vidarbh region of Maharashtra.
- ✓ Average yield of 2078 kg/ha.
- ✓ Moderately resistant to charcoal rot, anthracnose, target leaf spot and RAB diseases

# New Maize Hybrid Recommended by REC (2022)

## Him Palam Sankar Makka 3

- Maturity 90-95 days
- Plants are medium height with medium cob placement, orange flint
- Moderately resistant to lodging and diseases (TLB&BSR).
- Suitable for mid and high hills of the state.
- Average yield 70-75 q/ha

# Performance of Private Maize Hybrids (*kharif 2022 & 2023*)

## ❖Zone-I:

| Hybrid | Yield (q/ha) | Hybrid | Yield (q/ha) |
|---|---|---|---|
| 2745 | 89.72 | NK-6110 | 79.04 |
| PRADHAN-333 | 89.09 | KH-115-08-05 | 78.83 |
| 1024 A 384-01 | 85.33 | PAC-740 | 78.22 |
| K25-05 | 84.25 | AHC-2337 | 77.13 |
| DKC-8174 | 82.04 | DKC-7240 | 76.55 |
| KMH-8322 | 81.66 | KMH-8333 | 76.06 |
| KH-2136 Gold | 81.22 | PL-1515 Gold | 75.93 |
| SMS-371 | 80.51 | | |

# Performance of Private Maize Hybrids (*kharif 2022 & 2023*)

| Zone-II | | | |
|---|---|---|---|
| **Hybrid** | **Yield (q/ha)** | **Hybrid** | **Yield (q/ha)** |
| 1024 A 384-01 | 80.42 | K25-05 | 72.60 |
| KH-2136 Gold | 78.93 | KMH-8322 | 72.25 |
| KMH-8333 | 76.34 | HYM 333 | 71.85 |
| AHC-2337 | 74.42 | PRADHAN-333 | 71.57 |
| DKC-7240 | 74.38 | 2745 | 71.40 |
| **Zone-III** | | | |
| NK-6110 | 108.58 | 2745 | 102.14 |
| AHC-1212 | 103.53 | PL-1515 Gold | 100.03 |

# Performance of Private Hybrids (kharif 2022 and 2023)

- **RICE**
- Zone-I :
- ✓ Vijetha 100 (54.61q/ha), AHR- 8213 (50.75(q\ha) and Star-797 (50.02q/ha)
- Zone-II:
- ✓ Vijetha-100(55.47q/ha) AHR-8213 (53.47q/ha) and star-797v (49.60 q/ha)
- **Sorghum Sudan Grass (SSG)**
- Zone-I and Zone-II:
- ✓ BMR Rocket, SUPER-22, Besst-711 and Nutra Red
- **Bajra**
- Zone-I and Zone-II:
- ✓ 4747 and MILKFEED GOLD

# Vegetable Crops

| Status of vegetable production | |
|---|---|
| Area | More than 88 thousand hectares |
| Production | more than 18 lakh tones |
| Revenue Generation | ₹4000.0 crores |
| Contribution to State GDP | for more than 3.3 per cent |


# New Varieties Released and Notified (CVRC-2022)

| Vegetable Crops = 09 | |
|---|---|
| Pea | Him Palam Matar-1 and Him Palam Matar-2 |
| Edible Pod Pea | Him Palam Meethi Phali-2 |
| Chilli | Him Palam Mirch-1 and Him Palam Mirch-2 |
| Cucumber | Him Palam Kheera-1 |
| Cherry Tomato | Him Palam Cherry Yellow |
| Radish | Him Palam Mooli-1 |
| Onion | Him Palam Shweta |

# New Varieties

Him Palam Matar 1

Him Palam Matar 2

Him Palam Meethi Phali 1

Him Palam Mirch 1

# New Varieties

Him Palam Mirch 2

Him Palam Kheera 1

Him Palam Cherry Yellow

Him Palam Mooli 1

Him Palam Shweta

# Promising Varieties/Hybrids (Vegetable Crops)

Paprika line (DPPWR-4)

Capsicum DPBWR-39

Capsicum DPBWR-3

Okra DPO-22

Okra DPO-98-01

DDCY-1 (Bacterial wilt resistant)

Lettuce in hydroponics

Gyno-G-1(W) × Him Palam Kheera-2

# Promising Varieties/Hybrids (Vegetable Crops)


**DPCafH-5**
**Yield: 350–400 q/ha**

**DPCafH-3**
**Yield: 375–425 q/ha**

**HYBRID-2**
**Yield: 350–400 q/ha**

**HYBRID-4**
**Yield: 300–350 q/ha**

**HYBRID-5**
**Yield: 375–425 q/ha**

# Technologies Commercialized

| Technology/ Variety | Commercialization status |
|---|---|
| Palam Sankar Makka-2 | MoU with Nutranta Seeds Pvt. Ltd. for seed multiplication and marketing |
| Him Palam Rye Grass-1 | MoU with Nutranta Seeds Pvt. Ltd. for seed multiplication and marketing |
| | MoU with Durga Seeds Farm for seed multiplication and marketing |
| | MoU with Karishma Seeds Farm for seed multiplication and marketing |
| French bean var. Palam Mridula | MoU with Super Seed Pvt. Ltd. for seed multiplication and marketing |
| | MoU with Durga Seeds Farm for seed multiplication and marketing |
| Him Palam Matar-1 | MoU with Durga Seeds Farm for seed multiplication and marketing |
| | MoU with Welcome Crop Science for seed multiplication and marketing |
| | MoU with Nutranta Seeds Pvt. Ltd. for seed multiplication and marketing |
| | MoU with Super Seed Pvt. Ltd. for seed multiplication and marketing |
| | MoU with Krishma Seeds Farm for seed multiplication and marketing |
| | MoU with M/S S.S. Agri-solutions, Rudrapur, Uttrakhand for seed multiplication and marketing |
| Palam Tomato Hybrid-1 | MoU with Welcome Crop Science for seed multiplication and marketing |
| Onion variety Palam Lohit | MoU with Durga Seeds Farm for seed multiplication and marketing |

# Plant Genome Saviour Community Awards

## Kala Zeera

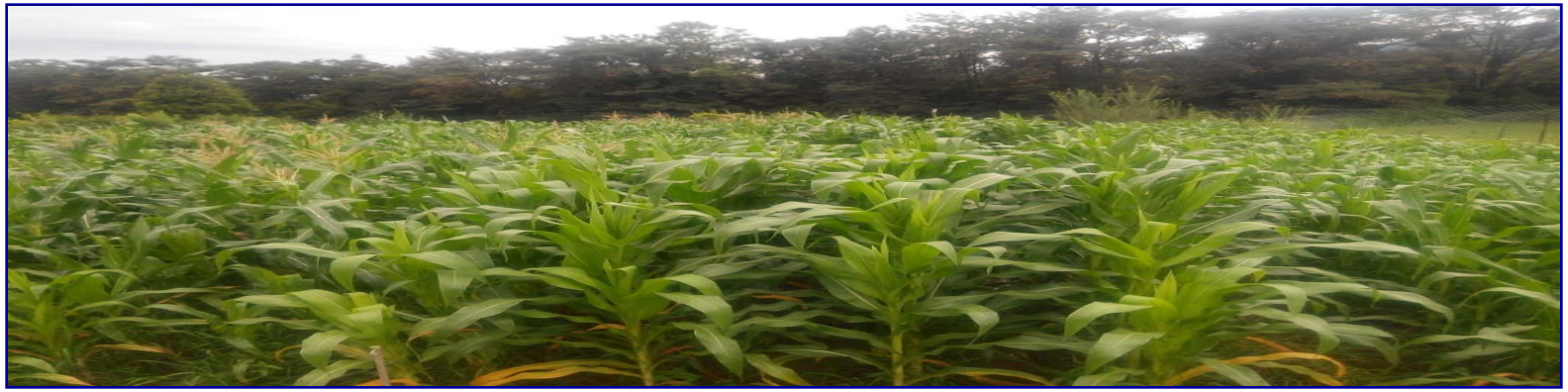
**Plant Genome Saviour Community Award on 12th September, 2023.** University scientists have compiled all the scientific data and assisted the Kala Zeera growing community to conserve, develop, popularize and formally registering its valuable land races with PPVFRA

## Paprola Kheera

Sh. Garib Das from village Burli Kothi near Paprola has been awarded Rs. One lakh 'Plant Genome Saviour Farmer Recognition' award by the Govt. of India with the help University Scientists

# ☞Seed Production

| Type of Seed | Total seed produced (q) |
|---|---|
| Nucleus seed | 12.306 |
| Breeder seed | 166.35 |
| Foundation seed | 23.845 |
| Total | 202.501 |



Aerial view of Seed Multiplication Farm at Palampur *Kharif* 2023

# Breeder & Foundation seed produced *kharif* 2023

| Crop | Breeder seed (q) | Foundation seed (q) |
|---|---|---|
| Cereals | 78.06 | 3.73 |
| Pulses | 33.045 | 14.745 |
| Oilseeds | 48.73 | 2.38 |
| Fodder Crops | 3.00 | 0.37 |
| Vegetable Crops | 3.515 | 2.62 |
| **Total** | **166.35** | **23.845** |

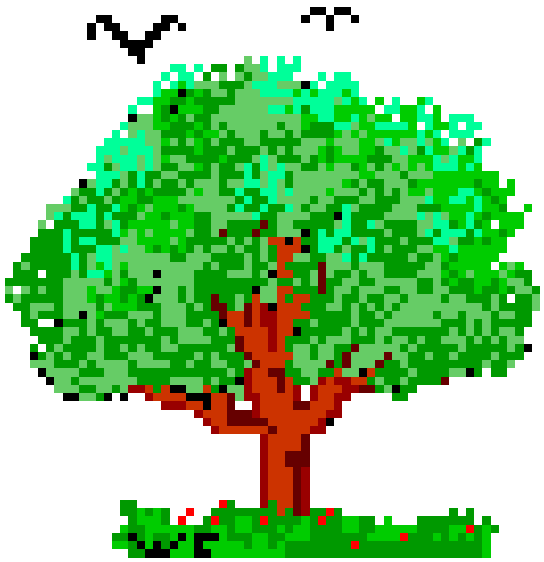
# Planting Material Production (No.)
## *kharif* 2023

| Crop | Plantation Material (No.) |
|---|---|
| Fodder Grasses | 25,000 |
| Horticulture | 2,647 |
| Vegetable Crops | 33,227 |
| **Total** | **60,874** |

# Vegetable Planting Material Production (q)
## *kharif* 2023

| Crop | Plantation Material (q) |
|---|---|
| Turmeric | 5.00 |
| Ginger | 2.00 |
| Elephant Foot Yam | 50.00 |
| Colocasia | 5.00 |
| Greater Yam | 5.00 |
| Rabi Onion | 3.00 |
| **Total** | **70.00** |

# CROP PRODUCTION



# ☞Identification of need based cropping systems for different agro-climatic conditions

❖**Yield :**

- **Okra-turnip-tomato followed by babycorn-broccolli-frenchbean followed by hybrid sorghum + hybrid bajra – oats + berseem and sunhemp-vegetable pea – frenchbean.**

❖**Net Returns:**

- **Okra-turnip-tomato followed by babycorn-broccolli-frenchbean.**

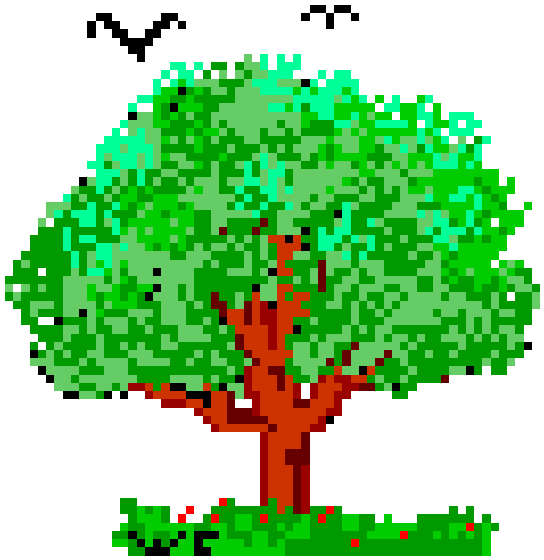
# ☞Development and validation of On-Station Integrated Farming System Model

- **Rice-wheat cropping system resulted highest yield followed by maize- wheat and soybean – gobhisarson (Cropping system). In horticulture cum vegetable block okra-radish-garlic resulted in highest yield followed by okra+soybean-pea+coriander and okra-potato-frenchbean.**

Okra crop in horticulture cum vegetable block

Paddy crop in an experiment

# NUTRIENT AND WATER MANAGEMENT



# Micro- and Secondary- Nutrients and Pollutant Elements in Soils and Plants

- Treatment combinations consisting of recommended or 125% of recommended N coupled with either two or three foliar feeding of Nano-N+ two foliar sprays of B @ 0.034% produced statistically similar yields in maize.

- Critical limit of Mo in French bean for optimum production – 6.17 mg $kg^{-1}$
- For okra fruit yield, seed priming with 0.05% B concentration coupled with 24 and 36 hours was optimal.

# Work under NFL Professor Chair

- Maize yield showed no significant difference with 125% and 150% of RDN, irrespective of Nano-N foliar feeding frequency. Similarly, combined application of Arka Microbial Consortium (AMC) at 11.25 l/ha with 125% RDF resulted in the highest maize yield, statistically similar to lower doses of AMC at the same RDF.

- Significantly higher yields were observed in soybean (15.9 q $ha^{-1}$) with S application via bentonite at 60 kg $ha^{-1}$, respectively.

# Nutrient Management
# Long Term Fertilizer Experiment

- **Combining 100% NPK with FYM @ 10 t $ha^{-1}$ for highest maize productivity.**
- **Periodic lime application with 100% NPK enhanced maize yield comparable to 100% NPK + FYM @ 10 t $ha^{-1}$.**
- **50% NPK with FYM @ 10 t $ha^{-1}$ produced maize yields akin to 100% NPK alone.**
- **Sulphur application is crucial; omitting it led to significant maize productivity decline, necessitating sulphur-containing P fertilizer like single super phosphate.**

# Integrated Water Management

## ❖ Rainfed maize-wheat systems:

*Conventional tillage with mulching, hydro seed priming, and integrated nutrient practices (50% organic + 50% inorganic) for enhanced crop and water productivity, profitability, and soil quality, including improved soil organic carbon and water storage.*

## ❖ Protected Conditions:

### ❑ *Tomato*

*NPK drip fertigation, with 25% applied as basal conventional fertilizer and 75% through water soluble fertilizers in 14 weekly splits.*

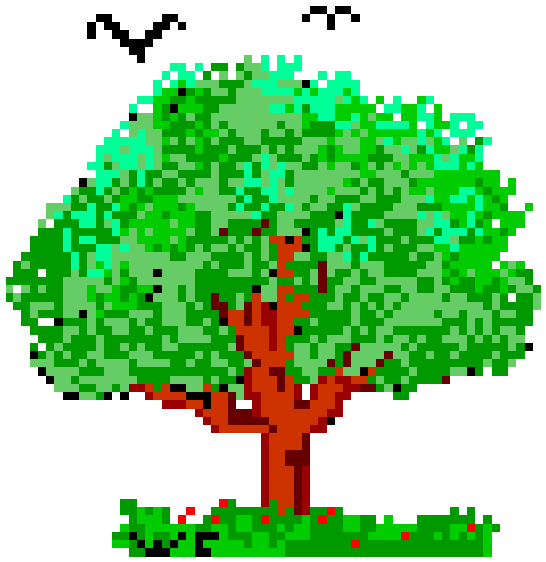
### ❑ *Strawberry:*

*25% NPK as basal and 75% through fertigation in 7 splits every 10 days*

### ❑ *Cucumber:*

*IPNS-based NPK drip fertigation, with 25% RDF applied as basal and 50% RDF through water soluble fertilizers in 10-14 splits at 5-7 days intervals along with liquid manure.*

# CROP PROTECTION



# Disease Management

## Eco friendly management of zonate leaf spot of Sorghum

Among the non-chemical methods three foliar sprays of extract of eupatorium ark @ 10% was found best, which gave 41.87 % disease control with 41.59 % increase in the yield over check. However, Three foliar spray of propiconazole @ 0.1% (Chemical check) was found most effective which gave 51.22 % disease control with 68.26 % increase in the green fodder yield over check.

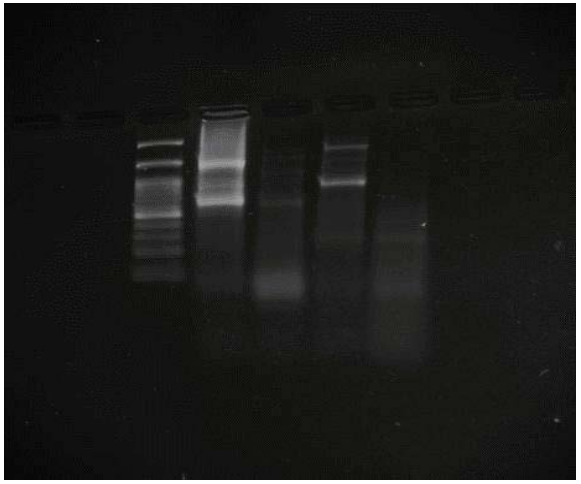
# Estimation of yield losses due to foliar diseases (anthracnose, gray leaf spot and zonate leaf spot) in fodder sorghum

Two foliar sprays of propiconazole @ 1ml/l at 20 and 35 DAE was found most effective 42.86 % disease control with 68.57 % increase in the green fodder yield over check.

# Phytoplasma Interception in Capsicum: First in India

**Capsicum plants showing phytoplasma-like symptoms *viz.,* vein-thickening, shortening of internodes, downward curling, puckering, greening, phyllody and stunting were subjected to Nested PCR based detection with universal primers. Desired amplicons as expected were observed, reconfirming the presence of Phytoplasma in suspected capsicum samples. This is the first record of Phytoplasma affecting bell pepper in India.**

**Capsicum plants showing phytoplasma-like symptoms *viz.,* vein-thickening, shortening of internodes**



**Gel electrophoresis analysis of Nested PCR reaction on 1.5 per cent agarose gel *via* using universal primers corresponding to 16S rDNA of Phytoplasma (R16F2n/R16FR2).**

# Collection, identification and conservation of wild edible and medicinal mushrooms

| Place | No. of specimen collected | No. of specimen deposited | Accession no. obtained |
|---|---|---|---|
| Palampur | 21 | 7 | 2 |
| Mandi | 37 | 9 | 2 |
| Bara | 2 | 1 | 0 |

## Mushrooms cultural deposited at DMR along with Accession Number

PLP-2: DMRX-2079
*Trametes* sp.

PLP-28: DMRX-2128
Unknown

PLP-30: DMRX-2129
Unkown

PLP-16: DMRX-2127
*Russula* sp.

# Shiitake Mushroom

- Ten strains of Shiitake mushroom were evaluated
- Strain IVTL-21-10 was found most promising having highest yield of 390.4 g with average fruit body weight of 35.2 gm followed by strain IVTL-21-09




# Insect Pest Management

# Termite fauna of Himachal Pradesh

- In Himachal Pradesh, termites belonging to ten genera *viz., Archotermopsis, Neotermes, Stylotermes, Coptotermes, Heterotermes, Speculitermes, Amitermes*, *Angulitermes, Odontotermes* and *Microtermes* were recorded associated with field crops, timber belonging to 5 families.
- Amongst them *Archotermopsis, Neotermes, Heterotermes, Stylotermes, Odontotermes and Angulitermes are of economic significance.*

***Archotermopsis***

***Neotermes***

***Heterotermes***

***Stylotermes***

***Odontotermes***

***Angulitermes***

# Fall army worm Management in Maize

- Amongst eight insecticides evaluated against fall army worm in maize at Palampur, two foliar applications during seedling and knee high stage of emamectin benzoate 5 SG @ 0.4 g/L water proved highly effective in reducing plant infestation by the pest. It was followed by spinetoram 11.7 SC @ 0.5 ml/L.

- On Farm Trial (OFT) conducted in district Una for the management of FAW revealed two sprays of neem (0.05%) at 20-day interval starting with 3-4 leaf stage followed by sprays of emamectin benzoate 5 EC (0.4 g/L) or flubendamide 480 SC (0.5g/L) were more effective than repeated sprays of emamectin benzoate 5 EC (0.4 g/L) (farmers practice) done after knee-high stage.

*Diagnosis of pest damage in early crop stage and taking appropriate measures is the key to success of FAW management*

# White Grub Management in Rajmash

Seed treatment with clothianidin 50 WDG @ 1.5 g/kg seed was most effective with only 6.0% plant damage against 18.3% plant damage in control

# Mass production and safety evaluation of insecticides to *Chrysoperla zastrowi sillemi:* a potential predator of soft bodied insects

- Mass production of predatory *Chrysoperla zastrowi sillemi,* a predator of soft bodied insects namely, whiteflies aphids has been standardized using rice moth eggs.
- Studies conducted to determine the direct and indirect effects of different insecticides revealed that azadirachtin, cyantraniliprole, diafenthiuron, imidacloprid and spiromesifen were safe to eggs and larvae of *C. zastrowi sillemi* when applied at maximum field recommended rates.
- Thiamethoxam was found to be toxic to *C. zastrowi sillemi*.
- Adults of chrysopid predator were more sensitive to all the insecticides particularly to spiromesifen.

Egg Larva Pupa Adult

Different life stages of the chrysopid predator, *Chrysoperla zastrowi sillemi*

# Management of shoot and fruit borer in brinjal

**For the management of shoot and fruit borer, spray emamectin benzoate 5 SG @ 0.002% or spinosad 45 SC @ 0.02% with the appearance of first moth catch in sex pheromone baited traps.**

**Repeat the spray at an interval of 14 days. Follow a waiting period of 4 days for emamectin benzoate and 2 days for spinosad for safe consumption of fruits.**

Damage to Shoots

Damage to fruits

# Management of root knot nematode *Meloidogyne incognita* in cucumber

**Application of Bioagent, *Bacillus amyloliquefaciens* @ 1kg/1000 $m^2$ at transplanting and 45 days after planting**

- ✓ **Reduction in gall index (40.0%)**
- ✓ **Reduction in number of egg masses (49.2%)**
- ✓ **Reduction in final nematode population (71.2%) along with increasing the yield by 24.8% as compared to untreated control.**

**Roots depicting galls in *Bacillus amyloliquefaciens* treatment**

**Roots depicting galls in Untreated Control**

# Weed Management

## ❖ Weed management in dry direct-seeded rice (DSR)

- *Pendimethalin 1000 g/ha fb bispyribac-sodium 25 g/ha + (metsulfuron methyl + chlorimuron ethyl) 4 g/ha (161.6% higher dry direct seeded rice yield and highest net returns of INR 49341/ha).*

## ❖ Weed management in soybean

- *Sulfentrazone + clomazone ( 322kg more yield : Kharif 2023)*

*Highest marginal benefit cost ratio (MBCR):*

- *Diclosulam followed by pendimethalin + imazethapyr (RM), fluazifop-p-butyl + fomesafen (RM) and sodium acifluorfen + clodinafop propargyl.*

# Weed Management

## ❖ Weed management under conservation tillage system on soybean based cropping system

- *Herbicide rotation treatment (HR-HR) and Integrated weed management treatment (IWM-IWM) resulted in higher yield, net return and B:C ratio of soybean and wheat.*
-

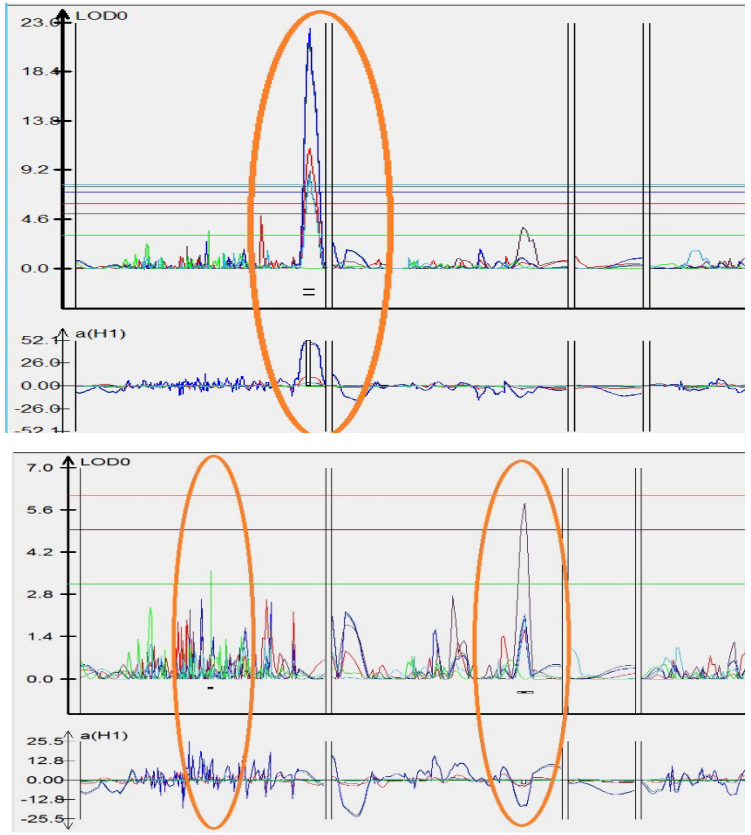
## ❖ Weed management in organically grown maize-wheat cropping system

- *Intensive cropping, crop rotation, intercropping and raised stale seed bed (RSSB) +mulch resulted in significantly lower total weed count and higher maize equivalent yield.*
- *Highest net returns and B:C ratio in the intensive cropping treatment.*

# Agricultural Biotechnology

# Mapping of genomic regions for plant height and growth habit in horsegram

- Four major QTLs one each for plant height (qPHT), growth habit trait (qGHT), seed index (qSI) and days to flowering (qDTF) were identified.
- qPHT, qGHT and qSI were situated on the LG1, while qDTF on the LG2. The QTLs explained 13.52 to 40.32% of the PVE.




**Position of the QTLs for the, plant height trait (PHT) and growth, habit trait (GHT) on first linkage groups days to flowering, (qDTF) and seed index (qSI) on 2nd , linkage groups of horsegram .**

# Identification of japonica rice accessions with wide compatibility gene *$S^n5$* for exploitation in *indica–japonica* hybridization programmes.

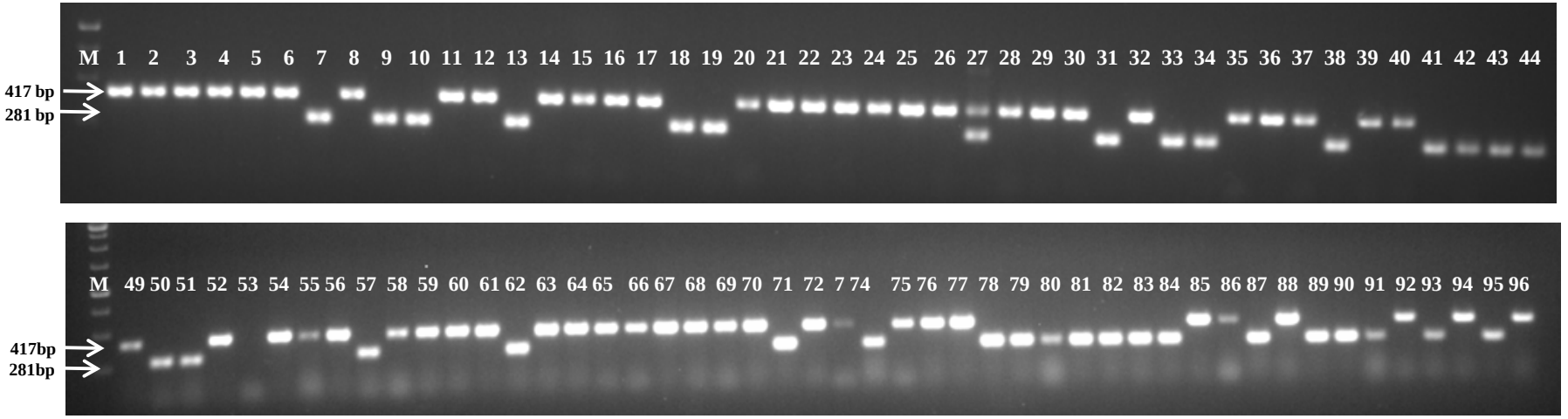



Fig: Genotyping of *japonica* landraces for wide-compatibility locus $S5^n$ using InDel marker S5-InDel. *Lines containing 281bp allele harbor wide-compatibility locus $S5^n$*

i. 456 japonica accessions obtained from National Gene Bank were genotyped with gene-derived InDel marker S5-InDel.
ii. 207 accessions harboring neutral allele *($S^n5$)* of wide compatibility locus were identified.

# Development of e Him Krishi and Him Biowealth portals

## e Him Krishi portal

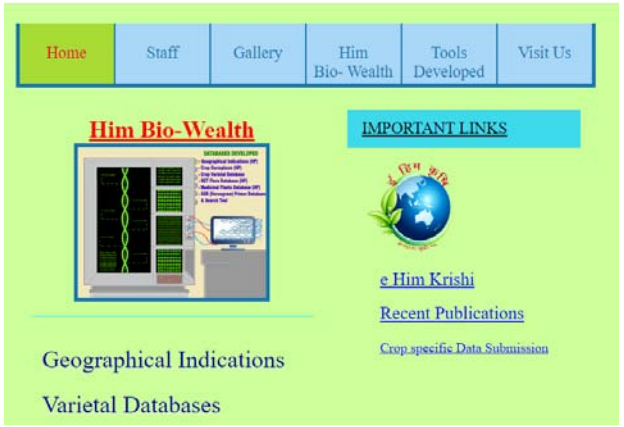
(http://www.hillagric.ac.in:1005/ekisan1/index.html)

**Portal provides information about package and practices approved by the CSKHPKV for various crops zone-wise in Hindi language, under one umbrella.**


## Him Biowealth portal

(http://hillagric.ac.in:1005/database.php)

**A database of all varieties released by the University till date and Geographic indications of Himachal Pradesh.**



# ☞Organic and Natural Farming








## Model Organic Farm

# ☞Zero Budget Natural Farm


# Crop Production- On Farm Trials

| Crop | Location | Yield (q/ha) |
|---|---|---|
| Paddy | Dhaulakuan (Farmers Fields) | 40.00* |
| | Palampur | 29.50 |
| | Mandi | 39.00* |
| Maize + Soybean (Maize Equivalent Yield) | Palampur | 20.58 |
| | Dhaulakuan Centre | 22.32 |
| | Dhaulakuan (Farmers Fields) | 34.01* |
| | Mandi | 38.90* |
| | Kullu | 30.20* |

* Higher than Organic Farming

# Crop Production- On Farm Trials

| Crop | Location | Yield (q/ha) |
|---|---|---|
| Finger Millet + Soybean (Finger Millet Equivalent Yield) | Palampur | 11.5* |
| | Dhaulakuan Centre | 11.1* |
| | Dhaulakuan (Farmers Fields) | 20.2* |
| | Mandi | 22.7* |
| | Kullu | 14.8 |
| Green chilly & okra | Dhaulakuan (Farmers Fields) | 1.3 & 2.2* |
| | Mandi | 7.3 & 4.3* |
| | Kullu | 1.0 & 3.0* |

* Higher than Organic Farming

# Soil & microbial studies

- Higher per cent organic carbon, dehydrogenase activity, available nitrogen & available potassium observed under natural farming treatment in comparison to organic farming treatment and farmer practices for most of the cropping sequences.
- General bacterial count was higher in organic farming treatment than natural treatment for all crops.
- P-solubilizing bacterial count was higher in natural farming treatment for green chilli + okra + beans + millet and garlic intercrop and finger millet + soybean crops.
- Actinomycetes count was higher in organic farming treatment for maize+soybean and finger millet + soybean crops.
- Nitrogen fixing bacterial count was higher in natural farming treatment than organic treatment for most of the crops.

# Plant Protection Studies

❖ *Riptortus* population in maize + soybean intercropping system:

- Highest efficacy was recorded in the treatment of Artemisia + Lantana extract 1:1 (81.44%) followed by treatment of Lantana extract (77.77%).

❖ Blister beetle in black gram:

- Highest efficacy was recorded in the treatment of Artemisia + Lantana extract 1:1 (81.24%) followed by treatment of Lantana extract (75.05%).

# ☞Crop Production under Natural Farming

Rice

Maize

Finger Millet

Foxtail Millet

# Farm Mechanization

## Farm Demonstration of Solar powered insect-traps under hilly conditions of H.P.

- The maximum catch of beetles was recorded in the month of July-August at Palampur (38.2%), Kullu (46.5 %) and Department of Agricultural Engineering (24.7%). There was a gradual decline in the density of beetle population in August-September, 2023.
- At Palampur, maximum percentage of the total catch was for that of *Anomala lineatopennis* (25.83 %) followed by *Holotrichia longipennis* (23.15 %) and *Maladera thomsoni* (10.78 %), whereas at Kullu, *Maladera thomsoni* (25.16 %) and *Maladera insanabilis* (19.71 %) were found in maximum numbers.

# ☞Future Research Priorities

## Crop Improvement

- Development of high yielding, early maturing, biotic & abiotic stress tolerant varieties coupled with improved quality in rice, maize, mash, soybean, fodder and potential crops
- Broadening the genetic base of various kharif crops by utilizing the wild genetic resources
- Development of CGMS based hybrids in rice
- Development of quality protein maize varieties
- Development of vegetable type soybean varieties
- Development of nutritive and persistent varieties of grasses and fodder legumes with quick regeneration capacity
- Speed breeding for acceleration of ongoing crop research endeavors with enhanced precision and efficiency by utilizing novel breeding tools

# ☞Future Research Priorities

## Vegetable Crops

- Gene Pyramiding of important diseases of vegetable crops
- Development of double haploids in cole crops
- Development of male sterility based hybrids in cauliflower, cabbage, broccoli and chilli
- Development of high yielding bacterial wilt, powdery mildew and Yellow Vein Mosaic Virus (YVMV) resistant varieties of vegetable crops.
- Development of parthenocarpic cucumber varieties for protected cultivation.
- Standardization of cultivation techniques for protected and hydroponic cultivation of potential vegetable crops

# ☞Future Research Priorities

## Crop Production

- Adverse impact of changing climate on productivity of kharif crops and their mitigation strategies.
- Carbon Footprints in different crop production scenarios.
- Biostimulants for enhancing productivity of different kharif crops.
- Crop- weather interaction and its impact on incidence of important diseases and pests in rabi crops (wheat and gobhi sarson).
- Compilation of Agrometeorological data of different locations in the state and use of this data for working out different agromet products
- Development, evaluation and validation of different cropping systems and Integrated Farming System modules for different sized land holders under varied agro-ecological conditions of Himachal Pradesh.

# ☞Future Research Priorities

## Nutrient Management

- Nutrient dynamics of soil with continuous cropping and recycling of organic resources in the form of plant or animal wastes with different systems over time
- Standardization of application schedules of newly released nano fertilizer
- Long-term effect of fertilizers and amendments on boron and molybdenum dynamics in maize-wheat system
- APSIM maize and wheat models for simulation and prediction of nutrient dynamics, soil acidity and crop productivity under long-term application of fertilizers andamendments
- Creation of fertility gradients for maize
- Development of fertilizers' equations for onion and garlic

# ☞Future Research Priorities

## Nutrient & Water Management

- Optimization of boron dose in maize and establishment of critical limit in acid soils of Himachal Pradesh
- Effect of boron and molybdenum application on their dynamics and maize productivity in an acid Alfisol
- Molybdenum & Boron fractions under different land uses in acid soils of H.P.
- Standardization of ETc based drip irrigation schedule in tomato and cucumber under protected conditions
- Standardization of IPNS based drip fertigation schedule in tomato under protected conditions
- Studies on sub surface manuring and NPK fertigation in onion under open condition .

# ☞Future Research Priorities

## Crop Protection

- Survey and surveillance of important diseases in HP to find out the impact of Global Warming/Climate Change
- Pathogenic and genetic diversity analysis of important plant pathogens and monitoring of races/ strains.
- Identification of resistant sources, study genetics of resistance, molecular mapping of R-genes and Pyramiding of R-genes in commercial varieties
- Development of IDM modules
- Testing & recommendation of CIB registered fungicides and their judicious use

# ☞Future Research Priorities

## Crop Protection

- Survey and surveillance of insect-pests and development of forecasting models
- Studies on population dynamics and management of invasive pests in Himachal Pradesh
- Standardization of mass production technology for important biological control agents and their utilization in biological control of insect-pests
- Management of roof knot and potato cyst nematodes

# ☞Future Research Priorities

## Natural Farming

- Multi-location testing of university recommended SPNF technology on targeted crops through FLDs on farmers' fields at three KVKs
- Seed production of identified crops (paddy, maize and finger millet) under SPNF conditions at ZBNF farm and through farmer participatory mode
- Surveillance of key insect pests of targeted crops
- Soil analysis and microbial studies on monitoring of soil health at farmers fields
- Development of Model SPNF Nodal Unit at CSKHPKV, Palampur for capacity building
- Production of vermicompost and other organic/natural farming inputs
- Development of guidelines for targeted crops under natural farming system

# ☞On Going Research Projects

| Particulars | No. of Projects | Budget Outlay (Rs. in lakhs) |
|---|---|---|
| AICRPs | 36 | 1900.00 |
| ICAR Funded Projects | 9 | 112.03 |
| DBT Funded Project | 6 | 334.65 |
| DST Funded Projects | 6 | 240.20 |
| HPCDP-JICA ODA, Hamirpur | 7 | 675.11 |
| Govt. of H.P. | 11 | 1119.13 |
| RKVY Projects | 7 | 389.39 |
| Miscellaneous Adhoc Projects | 28 | 246.89 |
| NABARD | 2 | 20.42 |
| CSIR, NBPGR, PPV &FRA, BARC | 5 | 74.21 |
| HIMCOSTE | 2 | 11.10 |
| GOI | 2 | 358.08 |
| Biodiversity International | 3 | 91.95 |
| Total | 124 | 5573.16 |

# Research Evaluation Committee Recommendation (2022)

| Programme Area | Variety/Recommendation |
|---|---|
| **Crop Improvement** | Him Palam Sankar Makka 3 (KMH-17-89) |
| | Him Palam Maize Composite 1 (L-315) |
| **Crop Production** | **New Recommendation for weed management in maize:** Post emergence application of either topramezone 25.2 g/ha+atrazine 750 g/ha at 2-3 leaf stage of weeds or post emergence application of tembotrione 120g/ha+atrazine 750g/ha at 2-3 leaf stage of weeds |

# Research Evaluation Committee Recommendation (2023)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Production | **New Recommendation for spacing in fodder oat:** Sowing of fodder oat in rows at 25 cm spacing in second fortnight of June after harvest of main crops in dry temperate region of H.P. |
| Weed Control | **Maize:** New recommendation for chemical weed control with Tembotrione (a new herbicide). |
| | **Rice:** Recommendation for chemical weed control in transplanted and puddle rice with Pretilachlor (a substitute for alachlor). |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Improvement | Him Palam Dhan 3 for inclusion in the package of practices for kharif crops |
| | Him Palam Dhan 4 for inclusion in the package of practices for kharif crops |
| | Release proposal of Him Palam Bhindi-1 (DPO-9801) |
| | Release proposal of Him Palam Capsicum Paprika (BWR-CP ) |
| | Release proposal of Him Palam Shimla Mirch-1 (BWR-3) |
| | Release proposal of Him Palam Shimla Mirch-2 (BWR-39) |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Improvement | Release proposal of Him Palam Matar-3 (DPP-SP-6) |
| | Release proposal of Cauliflower hybrid Him Palam Phoolgobhi Hybrid-1 (DPCafH 3) |
| | Release proposal of Cauliflower hybrid Him Palam Phoolgobhi Hybrid-2 (DPCafH 5) |
| | Release proposal of Chilli hybrid Him Palam Chilli Hybrid-1 (DPCHYB-4) |
| | Release proposal of Chilli hybrid Him Palam Chilli Hybrid-2 (DPCHYB-5) |
| | Release proposal of Chilli hybrid Him Palam Chilli Hybrid-3 ( DPCHYB-10) |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Improvement | Release proposal of Him Palam Tomato-1 |
| | Release proposal of Him Palam Tomato-2 |
| | Release proposal of Him Palam Yellow Capsicum (DDCY1) |
| | Release proposal of Him Palam Red Cherry (DPCTR-1) |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Production | Adhoc recommendation of Leaf type varieties of lettuce suitable for hydroponic system |
| | Seed Rate of Tomato, Capsicum & Cucumber under protected conditions |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Protection | Disease Management Recommendations |
| | Late Blight of Tomato |
| | Early Blight of Tomato |
| | Buckeye Rot of Tomato |
| | Purple blotch of Onion |
| | *Stemphylium* blight of Onion |

# Research Evaluation Committee Recommendation (2024)

| Programme Area | Variety/Recommendation |
|---|---|
| Crop Protection | Insect Pest Management |
| | Integrated management of greenhouse whitefly in tomato supplementary proposal |
| | Management of brinjal shoot and fruit borer |


Thanks