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INDIAN COUNCIL OF  
AGRICULTURAL RESEARCH

# DISTRICT WISE CONTINGENCY PLAN TO DEAL WITH **EL NIÑO**

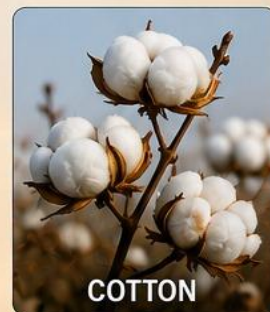
PREPAREDNESS | RESPONSE | RESILIENCE



BUILDING A  
DROUGHT RESILIENT  
PUNJAB



PADDY



COTTON



SUGARCANE



MAIZE



EARLY WARNING  
& MONITORING



WATER  
MANAGEMENT



SUSTAINABLE  
AGRICULTURE



COMMUNITY  
PARTICIPATION

TOGETHER, LET'S BUILD A RESILIENT PUNJAB

PREPARE TODAY • PROTECT TOMORROW • PROSPER TOGETHER

## Punjab

Punjab is the most agriculturally productive state in India and is popularly known as the “Granary of India” or the “Food Bowl of India.”. Agriculture forms the backbone of the state's economy and plays a vital role in ensuring the country's food security. Blessed with fertile alluvial soils, an extensive irrigation network, favourable climate, and progressive farming practices, Punjab has achieved remarkable success in agricultural production. The state's transformation began with the Green Revolution of the 1960s–70s, when the adoption of high-yielding variety (HYV) seeds, chemical fertilizers, mechanisation, and expanded canal irrigation enabled India to achieve food self-sufficiency. Today Punjab contributes 31.22% of rice and 46.24% of wheat in the central pool (up to Jan 2024) with a cropping intensity of 189% among the highest in India ([https://investpunjabblog.com/2024/08/02/punjab-the-food-bowl-of-india/#\\_ftn1](https://investpunjabblog.com/2024/08/02/punjab-the-food-bowl-of-india/#_ftn1)).

Agriculture in Punjab is characterized by intensive cultivation and high cropping intensity. Nearly four-fifths of the state's geographical area is under cultivation, making it one of the most agriculturally utilized regions in the country. The two dominant cropping seasons are *Kharif* (June–October), led by paddy and Rabi (October–April), dominated by wheat. The dominant cropping pattern is the rice–wheat rotation, with rice being the principal *Kharif* crop and wheat the major Rabi crop.

Agriculture in Punjab is sustained by a well-developed irrigation system comprising the Bhakra-Nangal and Harike canal networks and extensive tube-well irrigation, which provides assured water supply for crop cultivation." More than 90% of farm operations are mechanised with widespread use of tractors, combine harvesters, seed drills, and other modern farm machinery. Punjab Agricultural University (PAU), Ludhiana plays a crucial role in agricultural research, extension services, and dissemination of improved technologies to farmers.

Despite its achievements, the state faces serious challenges including rapid groundwater depletion, soil health degradation, stubble burning, overdependence on the wheat-rice cropping system and farmer indebtedness. Consequently, efforts are being made to promote crop diversification, sustainable farming practices, integrated farming systems, and efficient water management to ensure long-term agricultural sustainability. Government programmes such as the Crop Diversification Programme (CDP), Direct Seeded Rice (DSR) promotion, and micro-irrigation schemes under PMKSY are striving to steer Punjab's agriculture toward a more sustainable, climate-resilient future.

### Historical impact of El Nino to Punjab

The occurrence of El Nino has often led to below-normal monsoon rainfall in Punjab, creating moisture stress during the *Kharif* season. Although irrigation mitigates some impacts, reduced rainfall can affect crop performance and intensify pressure on groundwater resources. Major El Nino events such as 1982–83, 1987, 2002, 2009, 2015, and 2023 were accompanied by deficient monsoon rainfall across Punjab. Reduced rainfall led to lower groundwater recharge, leading to greater dependence on tube-well irrigation. Delays in monsoon arrival also hindered the timely transplantation of paddy, the state's primary *Kharif* crop, thereby affecting crop growth and productivity.

#### **Effect on Major crops:**

**Wheat:** Terminal heat stress, reduced grain-filling, yield loss 5–12%

**Paddy (Rice):** Delayed transplanting, yield drop 8–15%, higher irrigation costs

**Cotton:** Moisture stress, boll shedding, pest surge (whitefly, bollworm)

**Maize:** Dry spell damage, germination failure in sub-mountainous zones

**Sugarcane:** Reduced cane yield and sucrose content due to water stress

**Pearlmillet (Bajra):** moisture stress during flowering and grain filling can reduce yields significantly.

**Pulses (Moong, Mash/Urd):** Water stress during flowering and pod development reduces pod setting, grain filling, and overall productivity.

**Fodder Crops (Maize, Sorghum, Cowpea):** Reduced rainfall lowers biomass production and green fodder availability for livestock.

**Vegetables:** High temperatures and moisture stress affect flowering, fruit setting, and quality, resulting in lower yields.

#### **Contingency plans for major crops grown in Punjab**

| <b>Crop</b>         | <b>El Nino Situation</b>                             | <b>Recommended Contingency Measures</b>                                                                                                                                     |
|---------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Paddy (Rice)</b> | Delayed monsoon, water scarcity, higher temperatures | Adopt short-duration varieties (PR 126, PR 121, PR 128), follow Direct Seeded Rice (DSR), use alternate wetting and drying (AWD), prioritize irrigation at critical stages. |
| <b>Maize</b>        | Moisture stress during germination and flowering     | Use drought-tolerant hybrids, undertake timely sowing with pre-monsoon showers, apply mulching, adopt ridge-furrow planting, provide life-saving irrigation.                |



|                                              |                                                                |                                                                                                                                                                                         |
|----------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cotton</b>                                | Poor germination, flower shedding, reduced boll formation      | Use drought-tolerant Bt hybrids, maintain optimum plant population, apply mulching, undertake intercultural for moisture conservation, schedule protective irrigation during flowering. |
| <b>Sugarcane</b>                             | Reduced tillering and cane growth                              | Adopt drip irrigation and fertigation, apply organic mulches, perform trash mulching, ensure irrigation at critical growth stages, use drought-tolerant varieties.                      |
| <b>Pearl Millet (Bajra)</b>                  | Moisture stress during flowering and grain filling             | Promote drought-tolerant hybrids, timely sowing with conserved soil moisture, adopt wider spacing and moisture conservation practices.                                                  |
| <b>Pulses (Moong/Urd)</b>                    | Poor germination and pod setting under moisture stress         | Use short-duration varieties, seed treatment with bio fertilizers, sow immediately after rainfall, provide protective irrigation during flowering and pod development.                  |
| <b>Fodder Crops (Sorghum, Maize, Cowpea)</b> | Reduced biomass production and fodder shortage                 | Promote drought-tolerant fodder varieties, stagger sowing, prepare fodder banks, encourage silage and hay making.                                                                       |
| <b>Vegetables</b>                            | Heat stress, poor fruit set, increased irrigation demand       | Use mulching and drip irrigation, provide shade nets for sensitive crops, adopt short-duration varieties, ensure frequent light irrigation.                                             |
| <b>Wheat (Rabi)</b>                          | Reduced groundwater recharge affecting irrigation availability | Adopt zero tillage, use water-efficient varieties, conserve residual moisture, schedule irrigation at critical stages only.                                                             |
| <b>Mustard and Oilseeds</b>                  | Poor establishment due to moisture deficit                     | Early sowing using conserved soil moisture, use short-duration varieties, adopt ridge sowing and moisture conservation measures.                                                        |

Punjab's agriculture, despite its strong irrigation infrastructure and high level of mechanization, remains vulnerable to the impacts of El Niño through reduced monsoon rainfall, increased groundwater stress, and higher crop water requirements. The recurring occurrence of El Niño highlights the need for proactive contingency planning, efficient water management, and climate-resilient farming practices. Adoption of drought-tolerant and short-duration crop varieties, water-saving technologies such as

Direct Seeded Rice (DSR) and micro-irrigation, along with crop diversification, can significantly reduce climate-related risks. Strengthening weather-based advisories and promoting sustainable resource management will be crucial for safeguarding agricultural productivity, farmer livelihoods, and long-term food security in Punjab.

**Area under major crops**

| Crop      | Area (Lakh ha) |
|-----------|----------------|
| Paddy     | 32.43          |
| Cotton    | 1.60           |
| Sugarcane | 0.89           |
| Maize     | 0.86           |
| Moong     | 0.33           |
| Bajra     | 0.01           |

**Districts vulnerable to El Nino**

| Highly | Medium | Low                                |
|--------|--------|------------------------------------|
| Nil    | Nil    | Kapurthala,<br>Pathankot, Rupnagar |

# Actionable Comprehensive Plans for Contingency

|       |        |          |            |
|-------|--------|----------|------------|
| State | PUNJAB | District | KAPURTHALA |
|-------|--------|----------|------------|

## Rainfall info (mm)

| Month/season | Normal rainfall (mm) | Expected deficiency, % | Expected rainfall (mm) |
|--------------|----------------------|------------------------|------------------------|
| June-Sep     | 468.5                | More than 19%          | Less than 379.485      |
| June         | 53.5                 |                        |                        |
| July         | 160.3                |                        |                        |
| August       | 148.6                |                        |                        |
| September    | 106.1                |                        |                        |

Forecast probability for the season (as per IMD): Below Normal

## Irrigation info:

|                     |        |                       |        |
|---------------------|--------|-----------------------|--------|
| Net irrigated area: | 131488 | Gross irrigated area: | 258606 |
| Net Rainfed area    | 0      | Gross rainfed area    | 10049  |

## Source wise irrigation area details (ha)

| Source of irrigation | Net    | Gross  |
|----------------------|--------|--------|
| Canals               | -      | -      |
| Wells                | 131488 | 258606 |
| Tanks                | -      | -      |
| Other sources        | -      | -      |

## Crop Profile (Kharif)

### Cereals

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Rice      | 119134          | 119134              | 0                 |
| 2    | Jowar     | -               | -                   |                   |
| 3    | Maize     | 1045            | 1045                | 0                 |
| 4    | Bajra     | -               |                     |                   |
| 5    | Ragi      | -               |                     |                   |

## Pulses& Oilseeds

| S.No | Crop name      | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|----------------|-----------------|---------------------|-------------------|
| 1    | Arhar/ Redgram | 1               | 1                   | 0                 |
| 2    | Groundnut      | -               |                     |                   |
| 3    | Sesamum        | -               |                     |                   |
| 4    | Soyabean       | -               |                     |                   |
| 5    | Sunflower      | -               |                     |                   |
| 6    | Castor         | -               |                     |                   |

## Fibre

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Cotton    | -               |                     |                   |
| 2    | Jute      | -               |                     |                   |
| 3    | Mesta     | -               |                     |                   |
| 4    | Sunhemp   | -               |                     |                   |

## Other crops

| S.No | Crop name          | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|--------------------|-----------------|---------------------|-------------------|
| 1    | Sugarcane          | 3730            | 3730                | 0                 |
| 2    | Tobacco            | -               |                     |                   |
| 3    | Guar seed          | -               |                     | 0                 |
| 4    | Other Fodder crops | 10049           | 10049               | 0                 |

### Crop Plan- Beginning of the season

| Condition                            | Suggested Contingency measures |                             |                                |                    |                           |
|--------------------------------------|--------------------------------|-----------------------------|--------------------------------|--------------------|---------------------------|
| Early season drought (delayed onset) | Major Farming situation        | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures | Remarks on Implementation |
| Delay by 4 weeks                     | NA                             |                             |                                |                    |                           |

### Contingency measures- Mid season

| Condition                           |                         |                             | Suggested Contingency measures |                                             |                           |
|-------------------------------------|-------------------------|-----------------------------|--------------------------------|---------------------------------------------|---------------------------|
| Mid season drought (long dry spell) | Major Farming situation | Normal Crop/cropping system | Crop management                | Soilnutrient&moisture conservation measures | Remarks on Implementation |
| At flowering/ fruiting stage        | NA                      |                             |                                |                                             |                           |

### Contingency measures- End of the season

| Condition        |                         |                             | Suggested Contingency measures |                                             |                           |
|------------------|-------------------------|-----------------------------|--------------------------------|---------------------------------------------|---------------------------|
| Terminal drought | Major Farming situation | Normal Crop/cropping system | Crop management                | Soilnutrient&moisture conservation measures | Remarks on Implementation |



|                               |    |  |  |  |  |
|-------------------------------|----|--|--|--|--|
| (Early withdrawal of monsoon) |    |  |  |  |  |
|                               | NA |  |  |  |  |

### 2.1.2 Drought - Irrigated situation

| Condition                                              | Suggested Contingency measures     |                             |                                                                                                                       |                                                                |                                                                                                                            |
|--------------------------------------------------------|------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|                                                        | Major Farming situation            | Normal Crop/cropping system | Change in crop/cropping system                                                                                        | Agronomic measures                                             | Remarks on Implementation                                                                                                  |
| Delayed release of water in canals due to low rainfall | Tube well irrigated alluvial soils | Paddy                       | Prefer Short duration varieties (PR-115) and Basmati rice (Pusa Basmati-1, Pusa 1121, Punjab Basmati-2, Punjab Mehak) | Direct seeding of paddy and laser land leveling should be done | Direct seeding of rice saves about 20% of irrigation water. Laser leveling of field also saves 20-25 % of irrigation water |
|                                                        |                                    | Maize                       | Moong (PAU 911 and ML 818), Mash (Mash 114 and Mash 338).                                                             |                                                                |                                                                                                                            |
|                                                        |                                    | Wheat                       | Gram (PDG \$ and PDG 3) and Toria (PBT 37).                                                                           |                                                                |                                                                                                                            |
|                                                        |                                    | Sugarcane                   | Moong (PAU 911 and ML 818), Mash (Mash 114 and Mash 338                                                               |                                                                |                                                                                                                            |

| Condition                                              | Suggested Contingency measures    |                             |                                                                             |                                                                                                                             |                                                                                                                             |
|--------------------------------------------------------|-----------------------------------|-----------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|                                                        | Major Farming situation           | Normal Crop/cropping system | Change in crop/cropping system                                              | Agronomic measures                                                                                                          | Remarks on Implementation                                                                                                   |
| Limited release of water in canals due to low rainfall | Tubewell irrigated alluvial soils | Paddy                       | Prefer sowing of Basmati rice, Maize, Soybean and other pulses.             | Direct seeding of paddy laser land leveling should be done. Sunflower can be grown by transplanting of nursery in February. | Direct seeding of rice saves about 20% of irrigation water. Laser leveling of field also saves 20-25 % of irrigation water. |
|                                                        |                                   | Maize                       |                                                                             |                                                                                                                             |                                                                                                                             |
|                                                        |                                   | Wheat                       | Wheat can be replaced with oilseeds                                         |                                                                                                                             |                                                                                                                             |
|                                                        |                                   | Sugarcane                   | Moong (PAU 911 and ML 818), Mash ( Mash 114 and Mash 338                    |                                                                                                                             |                                                                                                                             |
|                                                        |                                   | Sunflower                   | Summer Moong (SML 832 and SML 668) and Summer Mash (Mash 1008 and Mash 414) |                                                                                                                             |                                                                                                                             |

| Condition                                          | Suggested Contingency measures    |                             |                                                  |                                                                      |                                                                                 |
|----------------------------------------------------|-----------------------------------|-----------------------------|--------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------|
|                                                    | Major Farming situation           | Normal Crop/cropping system | Change in crop/cropping system                   | Agronomic measures                                                   | Remarks on Implementation                                                       |
| Non release of water in canals under delayed onset | Tubewell irrigated alluvial soils | Paddy                       | Maize, Soybean (SL 744 and SL 525) and moongbean | Bed planting of soybean and maize laser land leveling should be done | Bed planting saves 20-25 % irrigation water. Laser leveling of field also saves |

| Condition               |                         |                             | Suggested Contingency measures                                                                 |                    |                             |
|-------------------------|-------------------------|-----------------------------|------------------------------------------------------------------------------------------------|--------------------|-----------------------------|
|                         | Major Farming situation | Normal Crop/cropping system | Change in crop/cropping system                                                                 | Agronomic measures | Remarks on Implementation   |
| of monsoon in catchment |                         | Maize                       | Moong (PAU 911 and ML 818), Mash (Mash 114 and Mash 338).                                      |                    | 20-25 % of irrigation water |
|                         |                         | Wheat                       | Oilseeds                                                                                       |                    |                             |
|                         |                         | Sugarcane                   | Sugar cane should be replaced with Moong ( P A U 911 and ML 818), Mash ( Mash 114 and Mash 338 |                    |                             |

| Condition                                                                |                                    |                             | Suggested Contingency measures |                    |                           |
|--------------------------------------------------------------------------|------------------------------------|-----------------------------|--------------------------------|--------------------|---------------------------|
|                                                                          | Major Farming situation            | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures | Remarks on Implementation |
| Lack of inflows into tanks due to insufficient /delayed onset of monsoon | Tube well irrigated alluvial soils | NA                          |                                |                    |                           |

| Condition                                             |                                   |                             | Suggested Contingency measures                                                                                                                         |                                                                                                           |                                                                                                                                                                                                                                         |
|-------------------------------------------------------|-----------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                       | Major Farming situation           | Normal Crop/cropping system | Change in crop/cropping system                                                                                                                         | Agronomic measures                                                                                        | Remarks on Implementation                                                                                                                                                                                                               |
| Insufficient groundwater recharge due to low rainfall | Tubewell irrigated alluvial soils | Paddy                       | Alternate crops to be sown like pulses (Moong PAU 911 and ML 818), Mash (Mash 114 and Mash 338), Oilseeds in place of predominant crops of rice-wheat. | Laser land leveling should be done.                                                                       | Laser leveling of field saves 20-25 % of irrigation water. Sowing of wheat with happy seeder immediately after harvest of paddy saves pre sowing irrigation Paired row trench planting of sugarcane saves about 10-15% irrigation water |
|                                                       |                                   | Maize                       |                                                                                                                                                        | 1% FeSO <sub>4</sub> spray in case of iron deficiency at weekly interval and decrease irrigation interval |                                                                                                                                                                                                                                         |
|                                                       |                                   | Wheat                       |                                                                                                                                                        | Wheat can be sown with Happy seeder technology immediately after harvesting of paddy.                     |                                                                                                                                                                                                                                         |
|                                                       |                                   | Sugarcane                   |                                                                                                                                                        | Paired row trench planting of sugarcane                                                                   |                                                                                                                                                                                                                                         |

#### Promising NRM technologies for Punjab:

- Zero till wheat sowing using Happy Seeder – Enables timely wheat sowing without burning rice residue, conserving soil moisture and reducing terminal heat stress.
- Management of rice straw using Baler-cum-Knotter – Collects paddy straw for alternate use, avoids residue burning, and facilitates timely sowing of the succeeding crop.
- Straw mulching in sugarcane – Conserves soil moisture, suppresses weeds, and reduces irrigation frequency during heat and moisture stress.

- Laser land levelling – Ensures uniform water distribution, improves soil moisture utilization, and increases irrigation water-use efficiency under water-scarce conditions.
- Broad Bed and Furrow (BBF) planting in cotton – Improves drainage during excess rainfall and conserves moisture during dry spells, reducing weather-related crop losses.
- Furrow irrigated raised bed planting of cotton – Enhances irrigation efficiency, minimizes waterlogging, and improves crop resilience under variable rainfall.
- Groundwater recharge through desilting of village ponds – Enhances groundwater availability for lifesaving irrigation during prolonged dry spells.
- In-situ crop residue management using rotavator – Incorporates residues into the soil to improve soil health, conserve moisture, and support sustainable crop establishment.
- Rice straw management using chopper-cum-shredder – Shreds crop residues for in-situ retention, improving soil organic matter and avoiding residue burning.
- Management of rice straw using reversible MB plough – Incorporates paddy residues into the soil, improving soil fertility and enabling timely field preparation for the next crop.
- Zero till wheat sowing using Super Seeder – Incorporates rice residues and sows wheat in a single operation, reducing cultivation cost and ensuring timely planting under heat stress scenarios.
- Rice straw management with Baler-cum-Knotter followed by Zero Till wheat sowing – Integrates residue removal with zero tillage to reduce burning, save irrigation, improve soil health, and avoid delayed sowing.

# Actionable Comprehensive Plans for Contingency

|       |        |          |            |
|-------|--------|----------|------------|
| State | PUNJAB | District | KAPURTHALA |
|-------|--------|----------|------------|

## Rainfall info (mm)

| Month/season | Normal rainfall (mm) | Expected deficiency, % | Expected rainfall (mm) |
|--------------|----------------------|------------------------|------------------------|
| June-Sep     | 952.1                | More than 19%          | Less than 771.201      |
| June         | 83.8                 |                        |                        |
| July         | 350.2                |                        |                        |
| August       | 363.2                |                        |                        |
| September    | 154.9                |                        |                        |

Forecast probability for the season (as per IMD): Below Normal

## Irrigation info:

|                     |       |                       |       |
|---------------------|-------|-----------------------|-------|
| Net irrigated area: | 46420 | Gross irrigated area: | 94631 |
| Net Rainfed area    | 0     | Gross rainfed area    | 63866 |

## Source wise irrigation area details (ha)

| Source of irrigation | Net   | Gross |
|----------------------|-------|-------|
| Canals               | 9672  | 9863  |
| Wells                | 36748 | 84768 |
| Tanks                | -     | -     |
| Other sources        | -     | -     |

## Crop Profile (Kharif)

### Cereals

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Rice      | 30071           | 22380               | 7691              |
| 2    | Jowar     | -               | -                   |                   |
| 3    | Maize     | 5699            | 292                 | 5407              |
| 4    | Bajra     | -               |                     |                   |
| 5    | Ragi      | -               |                     |                   |

### Pulses& Oilseeds

| S.No | Crop name      | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|----------------|-----------------|---------------------|-------------------|
| 1    | Arhar/ Redgram | -               |                     |                   |
| 2    | Groundnut      | -               |                     |                   |
| 3    | Sesamum        | 392             | 1                   | 391               |
| 4    | Soyabean       | -               |                     |                   |
| 5    | Sunflower      | -               |                     |                   |
| 6    | Castor         | -               |                     |                   |

### Fibre

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Cotton    | -               |                     |                   |
| 2    | Jute      | -               |                     |                   |
| 3    | Mesta     | -               |                     |                   |
| 4    | Sunhemp   | -               |                     |                   |

### Other crops

| S.No | Crop name          | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|--------------------|-----------------|---------------------|-------------------|
| 1    | Sugarcane          | 3664            | 2608                | 1056              |
| 2    | Tobacco            | -               |                     |                   |
| 3    | Guar seed          | -               |                     | 2029              |
| 4    | Other Fodder crops | 4579            | 2550                | 2029              |

### Crop Plan- Beginning of the season

| Condition                            |                         |                             | Suggested Contingency measures |                    |                           |
|--------------------------------------|-------------------------|-----------------------------|--------------------------------|--------------------|---------------------------|
| Early season drought (delayed onset) | Major Farming situation | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures | Remarks on Implementation |
| Delay by 4 weeks (Specify month)     | NA                      |                             |                                |                    |                           |

### Contingency measures- Mid season

| Condition                                                |                         |                             | Suggested Contingency measures |                                             |                           |
|----------------------------------------------------------|-------------------------|-----------------------------|--------------------------------|---------------------------------------------|---------------------------|
| Mid season drought (long dry spell, consecutive 2 weeks) | Major Farming situation | Normal Crop/cropping system | Crop management                | Soilnutrient&moisture conservation measures | Remarks on Implementation |

|                               |    |  |  |  |  |
|-------------------------------|----|--|--|--|--|
| rainless (>2.5 mm)<br>period) |    |  |  |  |  |
| At vegetative stage           | NA |  |  |  |  |

| Condition                           |                         |                             | Suggested Contingency measures |                                             |                           |
|-------------------------------------|-------------------------|-----------------------------|--------------------------------|---------------------------------------------|---------------------------|
| Mid season drought (long dry spell) | Major Farming situation | Normal Crop/cropping system | Crop management                | Soilnutrient&moisture conservation measures | Remarks on Implementation |
| At flowering/ fruiting stage        | NA                      |                             |                                |                                             |                           |

#### Contingency measures- End of the season

| Condition                                      |                         |                             | Suggested Contingency measures |                    |                           |
|------------------------------------------------|-------------------------|-----------------------------|--------------------------------|--------------------|---------------------------|
| Terminal drought (Early withdrawal of monsoon) | Major Farming situation | Normal Crop/cropping system | Crop management                | Rabi Crop planning | Remarks on Implementation |
|                                                | NA                      |                             |                                |                    |                           |

#### 2.1.2 Drought - Irrigated situation

| Condition                                              |                                    |                                                 | Suggested Contingency measures                                                                                                                                  |                                                                                                                                                                                                                     |                                               |
|--------------------------------------------------------|------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
|                                                        | Major Farming situation            | Normal Crop/cropping system                     | Change in crop/cropping system                                                                                                                                  | Agronomic measures                                                                                                                                                                                                  | Remarks on Implementation                     |
| Delayed release of water in canals due to low rainfall | Tube well irrigated alluvial soils | Paddy<br>Maize<br>Wheat<br>Rapeseed and Mustard | Long duration paddy var. should be replaced with short duration varieties (PR-115) and basmati rice (Pusa Basmati-1, Pusa 1121, Punjab Basmati-2, Punjab Mehak) | <ul style="list-style-type: none"> <li>Direct seeding of paddy and laser land leveling should be done which saves 20-25% irrigation water</li> <li>Zero till sowing of Raya which saves irrigation water</li> </ul> | Pun seed, NSC, P A U and progressive farmers. |

| Condition                                              |                                   |                                                                 | Suggested Contingency measures                                                                                                                                                 |                                                                                                                                                                                       |                                            |
|--------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|                                                        | Major Farming situation           | Normal Crop/cropping system                                     | Change in crop/cropping system                                                                                                                                                 | Agronomic measures                                                                                                                                                                    | Remarks on Implementation                  |
| Limited release of water in canals due to low rainfall | Tubewell irrigated alluvial soils | Paddy<br>Maize<br>Wheat<br>Rapeseed and Mustard<br>Summer Moong | Should be replaced with basmati rice, maize, wheat, oilseeds<br><br>maize ( PMH 2 and JH 3459), soybean (SL 744 and SL 525)<br><br>toria (PBT 37)<br>raya (PBR 210 and PBR 97) | Direct seeding of paddy and laser land leveling should be done which saves 20-25% irrigation water<br>Bed planting of summer Moong (67.5×37.5 cm) which saves 20-30% irrigation water | Pun seed NSC, P A U and Progressive farmer |



| Condition |                         |                             | Suggested Contingency measures                      |                    |                           |
|-----------|-------------------------|-----------------------------|-----------------------------------------------------|--------------------|---------------------------|
|           | Major Farming situation | Normal Crop/cropping system | Change in crop/cropping system                      | Agronomic measures | Remarks on Implementation |
|           |                         |                             | gobhisarson ( PGSH 51 and GSL 2)laced with oilseeds |                    |                           |

| Condition |                                                                            |                             | Suggested Contingency measures                                                                               |                                                                                                          |                                             |
|-----------|----------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------|
|           | Major Farming situation                                                    | Normal Crop/cropping system | Change in crop/cropping system                                                                               | Agronomic measures                                                                                       | Remarks on Implementation                   |
|           | Non release of water in canals under delayed onset of monsoon in catchment | Paddy                       | Maize (PMH 2 and JH 3459), soybean (SL 744 and SL 525)<br>moong varities like ML-267 and ML-613 can be grown | Bed planting of Soybean and Maize laser land leveling should be done Which saves 20-25% irrigation water | Punseed, N SC, P A U and Progressive farmer |
|           |                                                                            | Maize                       |                                                                                                              |                                                                                                          |                                             |
|           |                                                                            | Wheat                       |                                                                                                              |                                                                                                          |                                             |
|           |                                                                            | Rapeseed and Mustard        |                                                                                                              |                                                                                                          |                                             |

| Condition |                                                                          |                             | Suggested Contingency measures |                    |                           |
|-----------|--------------------------------------------------------------------------|-----------------------------|--------------------------------|--------------------|---------------------------|
|           | Major Farming situation                                                  | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures | Remarks on Implementation |
|           | Lack of inflows into tanks due to insufficient /delayed onset of monsoon | NA                          |                                |                    |                           |

| Condition |                                                       |                             | Suggested Contingency measures |                                                                                                                             |                                             |
|-----------|-------------------------------------------------------|-----------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|           | Major Farming situation                               | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures                                                                                                          | Remarks on Implementation                   |
|           | Insufficient groundwater recharge due to low rainfall | Paddy                       | No change                      | <ul style="list-style-type: none"> <li>Laser land leveling should be done which saves 20-25% of irrigation water</li> </ul> | Punseed, N SC, P A U and Progressive farmer |
|           |                                                       | Maize                       |                                |                                                                                                                             |                                             |
|           |                                                       | Wheat                       |                                |                                                                                                                             |                                             |
|           |                                                       | Rapeseed and Mustard        |                                |                                                                                                                             |                                             |

| Condition |                         |                             | Suggested Contingency measures |                                                                                                                                                                                                                                               |                           |
|-----------|-------------------------|-----------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|           | Major Farming situation | Normal Crop/cropping system | Change in crop/cropping system | Agronomic measures                                                                                                                                                                                                                            | Remarks on Implementation |
|           |                         | Summer moong                |                                | <ul style="list-style-type: none"> <li>Wheat can be sown with Happy seeder technology immediately after harvesting of paddy which saves pre sowing irrigation</li> <li>Summer moong can also be sown with Happy seeder technology.</li> </ul> |                           |

#### Promising NRM technologies for Punjab:

- Zero till wheat sowing using Happy Seeder – Enables timely wheat sowing without burning rice residue, conserving soil moisture and reducing terminal heat stress.
- Management of rice straw using Baler-cum-Knotter – Collects paddy straw for alternate use, avoids residue burning, and facilitates timely sowing of the succeeding crop.
- Straw mulching in sugarcane – Conserves soil moisture, suppresses weeds, and reduces irrigation frequency during heat and moisture stress.
- Laser land levelling – Ensures uniform water distribution, improves soil moisture utilization, and increases irrigation water-use efficiency under water-scarce conditions.
- Broad Bed and Furrow (BBF) planting in cotton – Improves drainage during excess rainfall and conserves moisture during dry spells, reducing weather-related crop losses.
- Furrow irrigated raised bed planting of cotton – Enhances irrigation efficiency, minimizes waterlogging, and improves crop resilience under variable rainfall.
- Groundwater recharge through desilting of village ponds – Enhances groundwater availability for lifesaving irrigation during prolonged dry spells.
- In-situ crop residue management using rotavator – Incorporates residues into the soil to improve soil health, conserve moisture, and support sustainable crop establishment.
- Rice straw management using chopper-cum-shredder – Shreds crop residues for in-situ retention, improving soil organic matter and avoiding residue burning.
- Management of rice straw using reversible MB plough – Incorporates paddy residues into the soil, improving soil fertility and enabling timely field preparation for the next crop.
- Zero till wheat sowing using Super Seeder – Incorporates rice residues and sows wheat in a single operation, reducing cultivation cost and ensuring timely planting under heat stress scenarios.
- Rice straw management with Baler-cum-Knotter followed by Zero Till wheat sowing – Integrates residue removal with zero tillage to reduce burning, save irrigation, improve soil health, and avoid delayed sowing.

# Actionable Comprehensive Plans for Contingency

|       |        |          |          |
|-------|--------|----------|----------|
| State | PUNJAB | District | RUPNAGAR |
|-------|--------|----------|----------|

## Rainfall info (mm)

| Month/season | Normal rainfall (mm) | Expected deficiency, % | Expected rainfall (mm) |
|--------------|----------------------|------------------------|------------------------|
| June-Sep     | 806.9                | More than 19%          | Less than 653.589      |
| June         | 98                   |                        |                        |
| July         | 278.6                |                        |                        |
| August       | 270.1                |                        |                        |
| September    | 160.2                |                        |                        |

Forecast probability for the season (as per IMD): Below Normal

## Irrigation info:

|                     |       |                       |        |
|---------------------|-------|-----------------------|--------|
| Net irrigated area: | 80845 | Gross irrigated area: | 131248 |
| Net Rainfed area    | 0     | Gross rainfed area    | 33890  |

## Source wise irrigation area details (ha)

| Source of irrigation | Net   | Gross  |
|----------------------|-------|--------|
| Canals               | 2266  | 5286   |
| Wells                | 78579 | 125962 |
| Tanks                | -     | -      |
| Other sources        | -     | -      |

## Crop Profile (Kharif)

### Cereals

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Rice      | 40673           | 40673               | 0                 |
| 2    | Jowar     | -               | -                   |                   |
| 3    | Maize     | 20245           | 6935                | 13310             |
| 4    | Bajra     | 267             | 219                 | 48                |
| 5    | Ragi      | -               |                     |                   |

#### Pulses& Oilseeds

| S.No | Crop name      | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|----------------|-----------------|---------------------|-------------------|
| 1    | Arhar/ Redgram | 9               | 9                   | 0                 |
| 2    | Groundnut      | -               |                     |                   |
| 3    | Sesamum        | 64              |                     | 64                |
| 4    | Soyabean       | -               |                     |                   |
| 5    | Sunflower      | -               |                     |                   |
| 6    | Castor         | -               |                     |                   |

#### Fibre

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Cotton    | 12              | 12                  | 0                 |
| 2    | Jute      | -               |                     |                   |
| 3    | Mesta     | -               |                     |                   |
| 4    | Sunhemp   | -               |                     |                   |

#### Other crops

| S.No | Crop name          | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|--------------------|-----------------|---------------------|-------------------|
| 1    | Sugarcane          | 2584            | 2579                | 5                 |
| 2    | Tobacco            | -               |                     |                   |
| 3    | Guar seed          | 1203            |                     | 2428              |
| 4    | Other Fodder crops | 12777           | 10349               | 2428              |
|      |                    |                 |                     |                   |

| Condition                                                           |                                                    |                                                          | Suggested Contingency measures |                                                                                                                                                                                                                                                                                                    |                           |
|---------------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Early season drought (delayed onset)                                | Major Farming situation                            | Normal Crop/cropping system                              | Change in crop/cropping system | Agronomic measures                                                                                                                                                                                                                                                                                 | Remarks on Implementation |
| <b>Delay by 4 weeks</b><br><br><b>2<sup>nd</sup> week of August</b> | Medium rainfall deep loamy sandy soils             | Maize/Moong/fallow-Wheat/Mustard/Chickpea                |                                | <b>For Kharif:</b><br>1. Increase row spacing<br>2. Thinning of crop<br>3. Use of local available plant material for mulch                                                                                                                                                                         |                           |
|                                                                     |                                                    | Maize/Sesame/fallow-Wheat+Raya /Chickpea/Barley/Taramira |                                | <b>For Rabi:</b><br>1. Harvest maize crop at physiological maturity in order to conserve soil moisture immediately ploughing and planking the field.<br>2. Deep sowing with minimum soil load on seed<br>3. Prefer presoaked seed for sowing<br>4. Drill half N and full P before sowing with pora |                           |
|                                                                     |                                                    | Pearlmillet-Wheat/Barley /Chickpea                       |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    | Maize/Moong/fallow-Wheat/Mustard/chickpea                |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    |                                                          |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     | Medium rainfall deep sandy loam to clay loam soils | Maize/Mash/-Wheat /Mustard /Chickpea                     |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    | Maize/Mash-Wheat+Raya /Chickpea/Barley/Taramira          |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    | Pearlmillet-Wheat/Barley /Chickpea                       |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    | Maize/Mash/-Wheat /Mustard /Chickpea                     |                                |                                                                                                                                                                                                                                                                                                    |                           |
|                                                                     |                                                    | Maize/mash-Wheat+Raya /Chickpea/Barley/Taramira          |                                |                                                                                                                                                                                                                                                                                                    |                           |

| Condition                                                                          |                                                |                                                           | Suggested Contingency measures                                                                                                                                         |                                                                                                                  |                           |
|------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------|
| Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period) | Major Farming situation                        | Normal Crop/cropping system                               | Crop management                                                                                                                                                        | Soil nutrient & moisture conservation measures                                                                   | Remarks on Implementation |
| At vegetative stage                                                                | Medium rainfall deep loamy sand to sandy soils | Maize/Moong/fallow-Wheat/Mustard/Chickpea                 | Every third row in case of maize/bajra can be thinned out and use as fodder(1/3 rd population)<br><br>Use anti transpirant<br><br>Life saving irrigation, if available | Use local available plant material for mulch<br><br>Apply 50% N through organic and 50% through inorganic source |                           |
|                                                                                    |                                                | Maize/sesame/fallow-Wheat+Raya /Chickpea /Barley/Taramira | -                                                                                                                                                                      | -                                                                                                                |                           |
|                                                                                    |                                                | Pearlmillet-Wheat/Barley /Chickpea                        | -                                                                                                                                                                      | -                                                                                                                |                           |
|                                                                                    | Medium rainfall deep sandy loam to clay loam   | Maize/Mash/-Wheat /Mustard /Chickpea                      | -                                                                                                                                                                      | -                                                                                                                |                           |
|                                                                                    |                                                | Maize/Mash-Wheat+Raya /Chickpea/Barley/Taramira           |                                                                                                                                                                        |                                                                                                                  |                           |
|                                                                                    |                                                | Pearlmillet-Wheat/Barley /Chickpea                        |                                                                                                                                                                        |                                                                                                                  |                           |
|                                                                                    |                                                | Maize/Mash/-Wheat /Mustard /Chickpea                      |                                                                                                                                                                        |                                                                                                                  |                           |
|                                                                                    |                                                | Maize/Mash-Wheat+Raya /Chickpea/Barley/Taramira           |                                                                                                                                                                        |                                                                                                                  |                           |

| Mid season drought (long dry spell) | Major Farming situation                        | Normal Crop/cropping system                               | Crop management                                                                                                                                                                                  | Soil nutrient & moisture conservation measures               | Remarks on Implementation |
|-------------------------------------|------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------|
| At flowering/ fruiting stage        | Medium rainfall deep loamy sand to sandy soils | Maize/Moong/fallow-Wheat/Mustard/Chickpea                 | If grain setting has occurred in maize, the tassels can be cut down to reduce transpiration<br>life saving irrigation, if available<br><br>Green gram and blackgram can be incorporated as green | Use local available plant material for mulch                 |                           |
|                                     |                                                | Maize/sesame/fallow-Wheat+Raya /Chickpea /Barley/Taramira |                                                                                                                                                                                                  | Apply 50% N through organic and 50% through inorganic source |                           |

|  |                                                    |                                                 |                                                                                                                                                     |   |  |
|--|----------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|--|
|  |                                                    | Pearlmillet-Wheat/Barley /Chickpea              | manure & conserve moisture for rabi crops<br><br>If rain comes Toria can be sown in mid september and intercropping of gobhi sarson in mid November |   |  |
|  | Medium rainfall deep sandy loam to clay loam soils | Maize/Mash/-Wheat /Mustard /Chickpea            | -                                                                                                                                                   | - |  |
|  |                                                    | Maize/Mash-Wheat+Raya /Chickpea/Barley/Taramira |                                                                                                                                                     |   |  |
|  |                                                    | Pearlmillet-Wheat/Barley /Chickpea              |                                                                                                                                                     |   |  |
|  |                                                    | Maize/Mash/-Wheat /Mustard /Chickpea            |                                                                                                                                                     |   |  |
|  |                                                    | Maize/Mash-Wheat+Raya /Chickpea/Barley/Taramira |                                                                                                                                                     |   |  |

| Condition                     |                                                |                             | Suggested Contingency measures                                                         |                                                                                                                                                                                                                                                                                                       |                           |
|-------------------------------|------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Terminal drought              | Major Farming situation                        | Normal Crop/cropping system | Crop management                                                                        | Rabi Crop planning                                                                                                                                                                                                                                                                                    | Remarks on Implementation |
| (Early withdrawal of monsoon) | Medium rainfall deep loamy sand to sandy soils | Paddy - Wheat               | Harvest whatever crop is available and immediately conserve the soil moisture for rabi | <ul style="list-style-type: none"> <li>• Intercropping of gobhi sarson in mid November in the Toria sown during mid September</li> <li>• Deep sowing with minimum soil load on seed</li> <li>• Prefer presoaked seed for sowing</li> <li>• Drill half N and full P before sowing with pora</li> </ul> |                           |

# Actionable Comprehensive Plans for Contingency

|       |           |          |       |
|-------|-----------|----------|-------|
| State | RAJASTHAN | District | ALWAR |
|-------|-----------|----------|-------|

## Rainfall info (mm)

| Month/season | Normal rainfall (mm) | Expected deficiency, % | Expected rainfall (mm) |
|--------------|----------------------|------------------------|------------------------|
| June-Sep     | 545.9                | More than 19%          | Less than 442.179      |
| June         | 67.8                 |                        |                        |
| July         | 185.5                |                        |                        |
| August       | 185.7                |                        |                        |
| September    | 106.9                |                        |                        |

Forecast probability for the season (as per IMD):Below Normal

## Irrigation info:

|                     |        |                       |        |
|---------------------|--------|-----------------------|--------|
| Net irrigated area: | 217450 | Gross irrigated area: | 251204 |
| Net Rainfed area    | 22513  | Gross rainfed area    | 179032 |

## Source wise irrigation area details (ha)

| Source of irrigation | Net    | Gross  |
|----------------------|--------|--------|
| Canals               | -      | -      |
| Wells                | 217450 | 251204 |
| Tanks                | -      | -      |
| Other sources        | -      | -      |

## Crop Profile (Kharif)

### Cereals

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Rice      | 12              | 12                  | 0                 |
| 2    | Jowar     | 13753           | 38                  | 13715             |
| 3    | Maize     | 619             | 31                  | 588               |
| 4    | Bajra     | 147149          | 985                 | 146164            |
| 5    | Ragi      | -               |                     |                   |



#### Pulses& Oilseeds

| S.No | Crop name      | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|----------------|-----------------|---------------------|-------------------|
| 1    | Arhar/ Redgram | 4               |                     | 4                 |
| 2    | Groundnut      | 20              | 4                   | 16                |
| 3    | Sesamum        | 533             | 5                   | 528               |
| 4    | Soyabean       | -               |                     |                   |
| 5    | Sunflower      | -               |                     |                   |
| 6    | Castor         | -               |                     |                   |

#### Fibre

| S.No | Crop name | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|-----------|-----------------|---------------------|-------------------|
| 1    | Cotton    | 22314           | 22222               | 92                |
| 2    | Jute      | -               |                     |                   |
| 3    | Mesta     | -               |                     |                   |
| 4    | Sunhemp   | -               |                     |                   |

#### Other crops

| S.No | Crop name          | Total area (ha) | Irrigated area (ha) | Rainfed area (ha) |
|------|--------------------|-----------------|---------------------|-------------------|
| 1    | Sugarcane          | 1               | 1                   | 0                 |
| 2    | Tobacco            | 3               | 2                   | 1                 |
| 3    | Guar seed          | 198             |                     | 2061              |
| 4    | Other Fodder crops | 3070            | 1009                | 2061              |