DROUGHT CONTINGENCY PLANNING MANUAL

Andhra Pradesh & Telangana

FOUNDATION LAYER

Part I — Drought Situation Classification

Part II — Agro-Climatic Zone Planning

Part III — Crop-wise Contingency Calendar

Part VI — Decision Trees

A field-reference and decision-support foundation for extension officers, FPOs, and digital advisory platforms including eKrishi

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Contents

How This Manual Is Built, and How To Use It

This is the foundation layer of a larger *Drought Contingency Decision Support Manual* for Andhra Pradesh and Telangana. It covers four of the fifteen parts envisaged in the full manual — the four that everything else depends on. Parts IV (variety substitution tables), V (crop replacement matrices), VII (symptom-based diagnosis), VIII (stage-wise advisories), IX (agronomic technologies), X–XIII (rainfall/water/soil/weather advisories), and XIV–XV (the digital rule engine and output formats) are designed to plug into the structure built here, and can follow once this foundation is reviewed.

What's solidly evidenced, and what needs local validation

Two kinds of claims appear in this document, and they are marked differently on purpose:

- Structural and directional guidance (e.g. "shift to short-duration variety by X weeks' delay," "prioritise irrigation at flowering over vegetative stage," "canal-command paddy responds to delay differently than rainfed paddy") is drawn from ICAR-CRIDA District Agriculture Contingency Plans (DACPs), PJTSAU/ANGRAU zone data, and AICRPDA-NICRA trial reports. These are cited in line with a Source line.
- Specific variety and hybrid names are the weak point of any contingency document, because release lists change every year and by zone. Where a named variety appears here, it is either (a) drawn verbatim from a sourced DACP as an illustration of the category of variety needed (e.g. "wilt-resistant, medium-duration, closer-spaced"), or (b) flagged as needing confirmation against PJTSAU's and ANGRAU's current-season release list before it goes into any farmer-facing material. None of the variety names in this draft should be printed on a WhatsApp advisory or flip chart without that check — several of the source DACPs are a decade or more old.

> *The ICAR-CRIDA DACPs cited throughout were mostly prepared in the 2011–2019 window for the undivided or newly bifurcated state, and several still carry the pre-2014 "Andhra Pradesh" state header even where the district is now in Telangana. They remain the best publicly available structured source for delay-based contingency logic at district level, but rainfall normals, variety names and even some district boundaries should be treated as needing a refresh — CSA's own PGS/FPO network data and PJTSAU/ANGRAU's current advisories are the natural source for that refresh.*

Part I — Understanding the Drought Situation

This part classifies the distinct drought and rainfall-deficit situations a farmer or extension officer can face, so that Part III (crop calendars) and Part VI (decision trees) can be triggered by a clear, named condition rather than a vague sense that "it hasn't rained."

1.1 Delay in Monsoon Onset

Delay is measured from the normal onset date for the district (typically 1st–2nd week of June across most of Telangana and coastal Andhra Pradesh, per IMD normals). The bands below follow the day-counts most useful for farmer decision-making; they map onto the coarser 2/4/6/8-week bands used in ICAR-CRIDA's own District Agriculture Contingency Plans, which are the source for the Part III crop calendars.

Delay	Expected impact	Crops most affected	Critical decision point	Urgency
7 days	Within normal sowing-window variance; negligible on its own	None specifically	Hold seed, continue normal plan	Low
10 days	Slight risk if compounded by a further dry spell	Direct-sown paddy nurseries, short-duration pulses	Watch the IMD 7-day forecast before committing seed	Low
15 days	Real risk to full-duration varieties; nursery-to-transplant window for paddy tightens	Transplanted paddy, maize, cotton	Shift to the recommended short-duration variety within the same crop (Part III)	Medium
20 days	Full-duration Kharif varieties no longer safe; yield penalty starts compounding	Cotton, maize, redgram	Variety substitution becomes mandatory; consider an intercrop	Medium–High
30 days	Crop-substitution zone begins; full-season crops largely unviable on shallow soils	Paddy, long-duration cotton	Shift to a different, shorter-duration crop (Part V logic)	High
45 days	Most standard Kharif options close out on shallow/medium soils; only very short-duration millets remain viable	Paddy, cotton, maize	Move to millets/pulses or a fodder-only plan; conserve inputs rather than gamble them	High
60 days	Kharif sowing largely foreclosed on rainfed land, except deep black soils holding residual moisture	All standard Kharif crops	Declare crop holiday on the affected plot; protect soil cover and prepare the Rabi plan	Critical

Source: Delay-band logic adapted from the ICAR-CRIDA District Agriculture Contingency Plan structure (2, 4, 6, 8-week delay bands used for Medak district, North/Central Telangana zone) and general dryland agronomy on sowing-window closure.

1.2 Other Drought and Water-Stress Situations

Delay in onset is only one trigger. The following situations need to be tracked separately because they call for different responses even at the same calendar date.

Situation	What it is	Expected impact	Critical decision point	Urgency
Early season drought	Dry spell in the first 3–4 weeks after sowing, during germination/establishment	Poor germination, patchy crop stand	Gap-fill vs. resow vs. abandon, decided ~15–20 days after sowing	High
Mid-season drought (long dry spell)	≥2–3 consecutive weeks with under ~2.5mm rainfall, during vegetative or flowering stage	Flower/boll/pod drop; reduced grain fill	Life-saving irrigation if any source exists; foliar 2% urea / KNO3 spray if not	High
Terminal drought	Rainfall failure at grain-filling/maturity, typically with early monsoon withdrawal	Shriveled grain, reduced test weight	Life-saving irrigation if possible; otherwise accept the loss and plan Rabi under residual moisture	High
Rainfall deficit (seasonal)	Cumulative shortfall (e.g. 20–40% below normal) spread across the season rather than one sharp dry spell	Chronic moisture stress, lower yield across the board rather than crop failure	Rebalance next season's crop mix toward drought-tolerant options; not usually an in-season action	Medium
Groundwater shortage	Falling water table or declining bore-well yield mid-season	Irrigation has to be curtailed for a standing crop	Ration water to flowering/fruit-set stage crops; deprioritize vegetative-stage irrigation	High
Canal water shortage	Delayed or reduced release from a reservoir-fed canal system	Incomplete puddling, delayed transplanting in delta tracts	Shift to direct-seeded rice or a shorter-duration variety; coordinate with the irrigation department's release schedule	High
Tank irrigation failure	Village tank or cascade fails to fill due to poor catchment rainfall	No transplanting water for tank-ayacut paddy	Convert the ayacut to a rainfed alternate crop for the season (redgram, maize, fodder)	High
Consecutive drought years	Two or more successive seasons of significant deficit	Depleted household reserves, distress asset sales, debt stress, soil-health decline from repeated low-biomass years	Shift from single-season crop contingency to household-level response — insurance claims, MGNREGA convergence, fodder banks, credit restructuring	Critical — livelihood, not just crop

Source: Categories and irrigated/rainfed distinctions follow the ICAR-CRIDA DACP template (Section 2.1.1 rainfed and 2.1.2 irrigated contingency structure, as used for Medak and West Godavari districts).

Part II — Agro-Climatic Zone-wise Planning

The manual's brief asked for ten planning zones across the two states. Andhra Pradesh and Telangana do not divide neatly into ten formally notified NARP zones — Telangana has three (sometimes four, counting the tribal tract separately) and undivided Andhra Pradesh's classic scheme had seven. The table below maps the ten requested planning units onto the zones actually used by PJTSAU, ANGRAU and ICAR-CRIDA, so that this document stays anchored to real research-station and DACP data rather than inventing boundaries.

Planning zone	Districts (representative)	Rainfall	Soil	Dominant crops	Drought probability / vulnerability
North Telangana	Adilabad, Komaram Bheem Asifabad, Nirmal, Mancherial, Nizamabad, Jagtial, Peddapalli, Kamareddy, Rajanna Sircilla, Karimnagar	860–1190 mm (avg. ~1033 mm)	Red soils, black soils, calcareous soil	Rice, sugarcane, jowar, pulses, maize, cotton, groundnut, turmeric, chillies	Moderate — decent average rainfall, but shallow-red-soil pockets and the Adilabad/Komaram Bheem tribal tract are more exposed
Central Telangana	Sangareddy, Medak, Siddipet, Jangaon, Warangal Urban & Rural, Mahboobabad, Jayashankar Bhupalapally, Bhadradri Kothagudem, Khammam	780–1210 mm	Mostly red soils	Cotton, rice, maize, greengram, mango, sugarcane, chillies	Moderate–High — wide rainfall range means high year-to-year variability; this is the zone with the most detailed DACP data available (Medak)
South Telangana	Vikarabad, Medchal–Malkajgiri, Hyderabad, Yadadri Bhuvanagiri, Rangareddy, Mahaboobnagar, Nalgonda, Suryapet, Wanaparthy, Nagarkurnool, Jogulamba Gadwal	Driest of the three TG zones — historically ~700–900 mm in the western/southern mandals	Red loamy soils (chalka)	Tank/bore-fed paddy, sunflower, sorghum, millets, pulses, orchard crops	High — most bore-well dependent zone; most exposed to the groundwater-shortage category in Part I
High-rainfall / tribal Telangana	Eastern forest-fringe mandals of Bhadradri Kothagudem, Mulugu, Komaram Bheem Asifabad bordering Chhattisgarh, Odisha and Maharashtra	>1200 mm in pockets	Forest-margin red/lateritic soils	Millets, pulses, minor forest produce, upland paddy	Lower rainfall-drought probability, but very high vulnerability when it does occur, given thin market access and PESA-area service gaps. Not a separately notified 4th PJTSAU zone in every classification

Planning zone	Districts (representative)	Rainfall	Soil	Dominant crops	Drought probability / vulnerability
					— treated here as a distinct planning unit because of its different rainfall and administrative character
North Coastal AP	Srikakulam, Vizianagaram, Visakhapatnam (rural), uplands of East Godavari	1000–1100 mm	Red clay soils, acidic pockets (pH 4–5), laterite	Paddy, groundnut, jowar, bajra, mesta, jute, sesame, blackgram	Moderate — cyclone risk co-occurs with drought risk depending on how the monsoon behaves that year
Godavari Delta	Canal-command core of East & West Godavari (part of the Krishna-Godavari NARP zone)	800–1100 mm zone average, but the delta itself is canal-fed, not rainfall-dependent	Deltaic alluvium	Paddy (two crops), maize on residual moisture	Low rainfall-drought probability but high canal-water-shortage exposure — this is an irrigation-contingency zone, not a rainfed-drought zone
Krishna Delta	Canal-command core of Krishna and Guntur	Same NARP zone as Godavari Delta	Deltaic alluvium, red loams, coastal sands, saline soils	Paddy, cotton, chillies, tobacco, sugarcane, horticulture	Same logic as Godavari Delta — canal release delay, not rainfall deficit, is the dominant trigger here
Southern Coastal AP	Nellore, Chittoor, southern Prakasam, coastal/eastern Cuddapah–Anantapur margin	700–1100 mm	Red loamy soils, shallow–moderate depth	Paddy, groundnut, cotton, sugarcane, millets	Moderate–High — Chittoor is repeatedly flagged among the more climate-vulnerable AP districts in NICRA assessments
Rayalaseema (scarce-rainfall zone)	Anantapur/Sri Sathya Sai, Kurnool/Nandyal, YSR Kadapa/Annamayya, Chittoor/Tirupati	500–750 mm core tract — Anantapur is among the lowest-rainfall districts in India after Jaisalmer	Red earths (chalka), red sandy soils, black-cotton pockets	Groundnut, cotton, foxtail millet (korra), sorghum, other millets, pulses, paddy in pockets	Highest — Anantapur, Kurnool and Chittoor are the districts most consistently named as most climate-vulnerable in AP across NICRA studies

Planning zone	Districts (representative)	Rainfall	Soil	Dominant crops	Drought probability / vulnerability
Tribal / agency regions (AP + TG combined)	Agency mandals of Srikakulam, Vizianagaram, Visakhapatnam, East Godavari (AP); Adilabad, Komaram Bheem Asifabad, Bhadradri Kothagudem, Mulugu (TG)	>1400 mm in the AP agency tract; more variable in the TG tribal tract	Lateritic/forest soils	Millets, pulses, horticulture (mango, cashew), minor forest produce	Rainfall is usually adequate, but impact is severe when drought does occur, given poor irrigation infrastructure and market isolation

Source: PJTSAU zone data (Northern/Central/Southern Telangana Zones — districts, rainfall, soils, crops); classic 7-zone Andhra Pradesh NARP classification (Krishna-Godavari, North Coastal, Southern, Scarce Rainfall, High Altitude & Tribal zones); ICAR-CRIDA DACPs for Medak, Kurnool and West Godavari; NABARD/NICRA district-vulnerability assessments for Chittoor, Anantapur, Kurnool.

> *Andhra Pradesh's 2022 reorganisation into 26 districts changed administrative boundaries but not the underlying agro-climatic logic — the zone table above uses the older, research-station-anchored district names because that is what the rainfall/soil/crop data and DACPs are keyed to. A companion crosswalk from old to new district names would be useful before this goes into eKrishi, since the app's location field will use current district names.*

Part III — Crop-wise Contingency Calendars

Rather than attempt all twenty-plus crops from the original brief at once — which would spread the evidence too thin to be trustworthy — this foundation layer works through one representative crop from each major group (paddy, cotton, pulses, oilseeds, millets). The delay-band structure and agronomic logic below are built to extend to the remaining crops in each group (greengram, blackgram, bengal gram and cowpea alongside redgram; sesame, sunflower and castor alongside groundnut; finger millet, foxtail millet and little millet alongside sorghum and pearl millet) once this template is reviewed.

3.1 Paddy

Delay / condition	Recommended action	Evidence status
Normal sowing	Full/medium-duration transplanted variety per RARS zone recommendation (delta tracts have historically relied on the MTU/BPT series — confirm the current PJTSAU/ANGRAU release list before use)	Needs current-season confirmation
Delay 7–10 days	No variety change yet; tighten the nursery-to-transplant window — use 25–28 day-old seedlings instead of the usual 30–35	Standard agronomic practice
Delay 10–20 days	Shift to a short/medium-duration variety (under ~130 days); in canal-delayed delta tracts, consider direct-seeded rice (DSR) to avoid losing the puddling-water window	Sourced — West Godavari DACP recommends AWD/DSR-type shifts under canal delay
Delay 20–30 days	Mandatory shift to a short-duration variety (under ~120 days) or DSR; drop the double-cropping plan for the season on tank- or bore-fed paddy	Standard agronomic practice
Delay 30–45 days	Rainfed/tank-fed tracts: replace paddy with a shorter-duration alternate crop (maize, pulses). Canal-command delta land: short-duration DSR can still proceed if canal water is assured	Standard agronomic practice
Delay >45 days	Skip paddy on rainfed and tank-fed land for the season; conserve inputs for Rabi. Canal-command land: only very short-duration DSR, and only with assured water	Standard agronomic practice

Source: Irrigation-timing and DSR/AWD logic drawn from the ICAR-CRIDA West Godavari District Agriculture Contingency Plan (Krishna-Godavari delta zone).

3.2 Cotton

Delay / condition	Recommended action	Evidence status
Normal sowing	BT hybrid per zone recommendation; June 2nd week–July 1st week window	Sourced — Medak DACP sowing window
Delay ~2 weeks	Continue with the plan, but select a shorter-duration BT hybrid where locally available	Sourced — Medak DACP: "selection of short duration BT cotton hybrids"

Delay / condition	Recommended action	Evidence status
Delay ~4–6 weeks	Black soils: shift out of cotton into redgram, or a redgram+maize intercrop. Red/chalka soils: shift to redgram + castor	Sourced — Medak DACP
Delay ~8 weeks	Cotton dropped from the plan on both soil types; redgram (wilt-resistant, medium-duration) becomes the fallback, sown at closer spacing (~90cm rows) to compensate for the shortened season	Sourced — Medak DACP
Delay >8 weeks (~45–60 days)	Horsegram or another very short-duration pulse/fodder option on black soils; otherwise conserve moisture and forgo a cash crop for the season	Sourced — Medak DACP

Source: This sequence is drawn from the ICAR-CRIDA DACP for Medak district (Central Telangana zone). Treat it as solidly evidenced for that zone and extrapolate cautiously — without local validation — to other zones or soil types.

3.3 Redgram (representing pulses: redgram, greengram, blackgram, bengal gram, cowpea)

Delay / condition	Recommended action	Evidence status
Normal sowing	Medium-duration cultivar suited to the zone	Standard agronomic practice
Delay up to 4 weeks	No change, or shift to a redgram+maize intercrop	Sourced — Medak DACP
Delay 4–8 weeks	Shift to wilt-resistant, medium-duration cultivars sown at closer spacing to compensate for the shortened season	Sourced — Medak DACP names "Maruthi" and "PRG-158" as the category of variety used in that zone as of the plan's preparation. These specific names are dated (plan prepared 2011) — verify current PJTSAU/ANGRAU equivalents before using the names themselves; treat this row as evidence for the wilt-resistant/medium-duration/closer-spacing strategy, not as a current sowing recommendation
Delay >8 weeks	Where redgram itself becomes unviable, drop to horsegram or another very short-duration pulse	Sourced — Medak DACP

Delay / condition	Recommended action	Evidence status
(Greengram note)	Under any delay, prefer short-duration, YMV (yellow mosaic virus)-resistant varieties — greengram is more delay-sensitive than redgram because of its shorter natural window	Sourced — Medak DACP: "Greengram: prefer short duration, YMV resistant varieties"

3.4 Groundnut (representing oilseeds: groundnut, sesame, sunflower, castor)

Delay / condition	Recommended action	Evidence status
Normal sowing	Full-duration bunch variety, particularly on red soils in the Rayalaseema/scarce-rainfall zone	Standard agronomic practice
Delay up to 3–4 weeks	Shift to a short-duration bunch variety (roughly 90–100 days)	Standard agronomic practice
Delay 4–8 weeks	Shift out of groundnut into foxtail millet or pigeonpea — both showed better relative returns under delayed sowing in AICRPDA on-station contingency trials at Anantapur (foxtail millet net return ~₹2,558/ha; groundnut ~₹10,850/ha under the same August-sown trial)	Sourced — AICRPDA-NICRA Anantapur trial data. These are trial-station figures from a specific year and should be read as evidence for the relative crop-choice logic, not as a current yield or price guarantee
Delay >8 weeks	Castor or a short-duration millet as the last rainfed option; otherwise conserve moisture for a Rabi crop (chickpea, safflower, sunflower) under residual soil moisture	Sourced — Medak DACP terminal-drought/Rabi-planning guidance

3.5 Sorghum & Pearl Millet (representing millets generally: sorghum, pearl millet, finger millet, foxtail millet, little millet)

Delay / condition	Recommended action	Evidence status
Normal sowing	Zone-recommended dual-purpose sorghum (grain + fodder) or pearl millet hybrid	Standard agronomic practice
Delay up to 4 weeks	No major change — millets are already the most delay-tolerant Kharif option in the portfolio	Standard agronomic practice; consistent with Medak DACP treating jowar as a fallback crop rather than one that itself needs a fallback

Delay / condition	Recommended action	Evidence status
Delay 4–8 weeks	Shift to a shorter-duration millet variety, or to a millet-pulse intercrop (sorghum + pigeonpea, pearl millet + cowpea) — the combination has documented water-use-efficiency advantages from differing root depth and staggered maturity	General dryland farming-systems principle, well established in the literature
Delay >8 weeks	Millets remain viable later into the season than any other Kharif crop; where even this window closes, sow purely as a fodder crop	Standard agronomic practice

Part VI — Decision Trees

These are written as step / condition / action tables rather than boxes-and-arrows diagrams, because that is the form that both a field officer flipping through a printed guide and a future JSON rule base (Part XIV) can use directly without translation. Two trees are given: a universal drought-response tree that applies regardless of crop, and a parallel tree for irrigated/canal-command situations, which follow a different logic than rainfed drought.

4.1 Universal Rainfed Drought-Response Tree

Step	Condition	Action / next step
1	Has the monsoon arrived in the normal sowing window?	Yes → go to Step 2. No (delayed) → go to Step 3.
2	Normal onset — is germination/crop stand normal 15–20 days after sowing?	Normal → continue as planned. Poor/patchy → go to Step 2a.
2a	Is the sowing window still open for this crop?	Yes → gap-fill or resow with the same or a shorter-duration variety. No → move to the crop-replacement matrix (Part V).
3	How long has onset been delayed? (see Part I, Table 1)	≤10 days → hold seed, watch the IMD 7-day forecast, no action yet. 10–30 days → variety substitution within the same crop (Part III / Part IV). 30–45 days → crop substitution within the same land-use type (Part V). >45 days → declare a crop holiday on the affected plot, or shift to a fodder-only plan; conserve inputs for Rabi.
4	Crop is established — is there a dry spell of ≥2–3 weeks with under ~2.5mm rainfall?	No → continue routine monitoring. Yes → go to Step 4a and check crop stage.
4a	What growth stage is the crop at?	Vegetative → foliar 2% urea spray; frequent intercultivation to control weeds and conserve moisture; irrigate alternate rows if any water source exists. Flowering / reproductive → this is the yield-determining stage — prioritise life-saving irrigation here over any other stage; foliar 1% KNO3 spray if no irrigation source is available. Grain-filling / terminal → life-saving irrigation if any source exists; otherwise accept the yield loss and shift attention to the Rabi plan.

Source: Stage-priority logic (protecting flowering-stage irrigation first) and the foliar-spray responses are drawn from the ICAR-CRIDA Medak DACP mid-season and terminal-drought sections.

4.2 Irrigated / Canal-Command Parallel Tree

Delta and canal-command land does not fail the way rainfed land does — the trigger is a release or inflow problem, not a rainfall problem, so it needs its own tree rather than being forced into the rainfed one.

Step	Condition	Action / next step
5	Is the canal release delayed or reduced relative to the normal schedule?	Yes → shift to direct-seeded rice or a shorter-duration variety; coordinate with the irrigation department's release schedule rather than waiting it out (Part III, §3.1).

Step	Condition	Action / next step
6	Has the tank or cascade failed to fill from catchment rainfall?	Yes → convert the ayacut to a rainfed alternate crop for the season (redgram, maize, fodder) rather than waiting for a late fill that may not come.
7	Is the groundwater table / bore-well yield declining mid-season?	Yes → ration water to flowering/fruit-set-stage crops first; deprioritize vegetative-stage irrigation; consider discouraging a second rice crop in favour of a less water-intensive one (sunflower, redgram, chickpea).

Source: Drawn from the ICAR-CRIDA Medak DACP irrigated-situation section (2.1.2) and the West Godavari DACP's AWD/water-quality guidance.

What Comes Next

This foundation layer gives Parts I, II, III and VI a defensible, sourced base. The parts that build on it are, in the order they'd be most useful to develop next:

- Part IV — Variety Replacement Guide: expand the illustrative variety rows in Part III into full substitution tables, with every named variety checked against PJTSAU's and ANGRAU's current-season release lists rather than the dated DACP names used here.
- Part V — Crop Replacement Matrix: the "shift to a different crop entirely" step referenced in the decision trees (Step 3, >30 days) needs its own matrix — which crop substitutes for which, by zone and soil type.
- Part VII — Symptom-Based Diagnosis: field-visible symptoms (leaf rolling, blue-green paddy leaves, cotton square drop, cracking soil) mapped to likely cause and immediate action — useful precisely because most farmers notice the plant before they notice the rain gauge.
- Part XIV — Digital Decision Engine: once Parts IV and V exist, the tables in this document translate fairly directly into the JSON rule base an eKrishi module would need — the step/condition/action structure in Part VI was written with that translation in mind.
- Extend Part III's five representative crops to the remaining fifteen (greengram, blackgram, bengal gram, cowpea, sesame, sunflower, castor, maize, sunflower, finger/foxtail/little millet, chillies, turmeric, vegetables, fodder crops), following the same template and the same evidence-status labelling.

A short companion note on the current AP district reorganisation (old-to-new district crosswalk) would also be worth producing before any of this goes into eKrishi's location logic, since the zone table in Part II is keyed to the older, research-station-anchored district names.