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Impact of *El Nino* on oil palm cultivation and mitigation measures (*Contingency plan*)

As oil palm is a water-intensive perennial crop requiring a uniform distribution of moisture throughout the year, disruptions in monsoonal rain combined with elevated temperatures will directly influence immediate physiological growth and long-term bunch yields. Hence, emphasis should be placed on protective and adaptive management practices to sustain palm health and productivity during prolonged drought and heat stress conditions associated with this year's *El Niño*.

I. Impact on growth and productivity

Under *El Niño* conditions, land surface temperatures rise while daytime relative humidity drops, creating a severe atmospheric moisture deficit. When the VPD exceeds optimal thresholds, oil palms automatically close their stomata during peak daylight hours to prevent internal water loss (xylem cavitation). This sharply reduces the rate of photosynthesis, leading to stunted vegetative growth, delayed frond production, and a reduction in total leaf area. Further, if the dry conditions prolong, it is likely that the bunches may abort and maleness will be more. Immature palms (less than 3 years old) possess shallow, developing root systems that are highly vulnerable to topsoil drying. Extended dry spells during the traditional monsoon months will significantly threaten the survival rates of new field plantings, particularly in states like Chhattisgarh or regions with low-retention soils like the North-Eastern hills, unless intensive supplemental watering is maintained.

Recommendations

A. Rest of India States

1. Adopting protective irrigation and moisture conservation measures: Ensure regular micro-irrigation and avoid prolonged moisture stress during summer. The estimated water requirements during May - September under the present *El-Nino* conditions are given in Table 1. Frequent application of water wherever possible is highly recommended.

Table 1: Estimated Water requirement from May to September (litres/palm/day)

State	May	June	July	August	September
Andhra Pradesh	300	265	225	215	210
Chhattisgarh	300	265	225	215	210
Gujarat	310	270	230	220	200
Karnataka	280	260	220	210	200
Kerala	200	180	170	150	150
Maharashtra	300	265	225	215	210
Odisha	280	260	220	210	200
Tamil Nadu	300	265	225	215	210
Telangana	300	265	225	215	210

2. Providing in-situ mulching: At least, a single-layer mulch of pruned fronds or organic biomass directly over the active root zone around the base saves good quantity of soil moisture. This cools the soil micro-climate and minimizes non-productive water loss.

3. Applying additional dose of potassium: Avoid heavy fertilizer application during peak heat stress periods without adequate irrigation. In districts experiencing high Vapor Pressure Deficit (VPD) and heat stress, provide 0.5 kg of Muriate of Potash during the month of May or June as an additional dose, in addition to the regular four split doses of potassium per palm, to withstand the water stress during deficit monsoon conditions.

4. Nutrient Delivery Optimization: Under moisture-stress scenarios, soil-applied fertilizers lose efficacy due to poor solubility and root uptake restrictions. In Fertigation through venturi system, follow 5 – 3 – 10 kg of urea, DAP and MOP per acre per month for the summer season (May and June), then follow regular dose of 5 – 3 – 5 kg for rest of the months.

5. Enhance climate preparedness and field monitoring: Monitor weather advisories, soil moisture, and pest incidence regularly, as drought-stressed palms are more vulnerable to pests and diseases. Promote rainwater harvesting, farm ponds, and protective irrigation planning to minimize the impact of possible deficit monsoon conditions associated with the developing El Niño event.

6. Avoid leaf pruning: Avoid severe leaf pruning during summer, as reduced canopy may increase heat stress. Maintain at least 30-35 functional leaves per palm.

B. North Eastern states

1.Supplemental Irrigation: While the North-East relies heavily on rainfed cultivation for oil palm, during hot, dry intervals in June–September, providing 120–150 liters of water per palm per day ensures steady crop growth and prevents bunch abortion.

Table 2: Estimated Water requirement from May to September (litres/palm/day)

State	May	June	July	August	September
Arunachal Pradesh	150	140	140	120	100
Assam	150	140	140	120	100
Manipur	150	140	140	120	100
Meghalaya	150	140	140	120	100
Mizoram	150	140	140	120	100
Nagaland	150	140	140	120	100
Tripura	150	140	140	120	100

2.Terracing & Contour Mulching: For hill-plantation management, maintaining a layer of organic biomass or pruned fronds along the downhill contour of the palm basins is critical. This single-layer mulch serves a dual purpose: it cuts down bare-soil surface evaporation during dry, hot conditions and anchors the soil against heavy downpours.

II. Impact on insect pests

Due to *El Niño* conditions, the prevailing high temperatures are likely to adversely affect the biology and survival of existing pests such as the invasive whitefly complex and the rhinoceros beetle. However, delayed monsoon onset coupled with elevated minimum temperatures may prolong the incidence and severity of sucking pests, including the rugose spiraling whitefly, Bondar's nesting whitefly, and palm nesting whitefly. Alterations in the seasonal incidence patterns of both sucking pests and defoliators, as well as their natural enemies, are also anticipated.

Recommendations:

- Continuous monitoring of pest incidence and undertaking recommended ICAR-IIOPR management practices.
- Climate-resilient biocontrol agents, such as *Aspergillus* sp. R55 should be used for the management of whiteflies in oil palm plantations.

III. Impact on pollinating weevils

The biology, survival, population dynamics, and distribution of the pollinating weevil are likely to be adversely affected by high temperatures, ultimately resulting in poor pollination and consequent bunch failure. Furthermore, the negative effects of elevated temperatures on the biology of the weevil and the opening of male inflorescences have already been documented. The establishment of pollinating weevils in newly established or isolated plantations may also be reduced under such conditions.

Recommendations:

- Modifications in drip irrigation practices, such as opening dummy outlets in drip system to enhance field-level relative humidity, have been promoted among oil palm growers during this period to mitigate heat stress on both pollinating weevils and oil palm.
- Promotion of intercrops such as cocoa, along with border crops/windbreaks like Subabul and Casuarina, is being encouraged to reduce heat stress in oil palm plantations.
- For better establishment, the release of pollinating weevils should be avoided during periods of high temperature and heavy rainfall.

IV. Impact on incidence of diseases

Physiological moisture stress prevailing under *El Niño* conditions may predispose oil palm plantations to increased incidence of *Ganoderma*-induced basal stem rot (BSR). Such conditions may also facilitate the spread of the pathogen.In addition, BSR diagnosis based on skirted symptoms may become more complicated as its symptoms overlap with effects associated with high vapour pressure deficits.

Recommendations:

- Popularization of the early diagnostic kit for BSR developed by ICAR-Indian Institute of Oil Palm Research.
- Commercialization and large-scale production of *Trichoderma* consortium for management of BSR.