Impact of the Gaja cyclone on coconut in Tamil Nadu and actionable strategies reviving livelihood

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Introduction

Natural disaster has become a common phenomenon in the East Coast region and the recent cyclone Gaja is yet another example that has taken more than 63 human lives, several hundreds of cattle and displaced many human beings in East Coast of Tamil Nadu. A scientific team from ICAR-CPCRI conducted a rapid assessment on the damage impact of cyclone Gaja on coconut palms in particular. The cyclone Gaja crossed landfall in Tamil Nadu during the late night hours of 15th November 2018 and early wee hours of 16th November 2018 causing worrisome impact to mankind and crops in the region. Wind speed exceeding 115 kmph had in fact caused huge crop and property loss. Coconut palm which could withstand Ockhi as well as the recent flood fury in Kerala was badly damaged due to Gaja in all affected villages in the districts of Thanjavur, Thiruvarur, Pudukkottai, Nagapatinam, Dindigul and Tiruchirapalli. However, the impact of Gaja on coconut in Tiruchirappali and Dindigul districts is insignificant. In several affected villages more than 75% of the palms were damaged and uprooted leading to complete loss of palms in the region and severely affecting the livelihood of coconut farmers.

About the region

East coast region of Tamil Nadu encompasses the Cauvery delta belt where coconut is one of the predominant crops cultivated currently. The crop provides ecological and livelihood security to millions

of people in the region. Soil is found to be mainly clay-loam and sandy alluvial in nature which makes water in stagnation even under slight drizzling due to limited percolation ability of soil. Tall is the common coconut variety in the region and few hybrids are also recorded in this locality during the snap survey.

Coconut statistics

In the East Coast of Tamil Nadu coconut has been extensively cultivated in the Cauvery delta region during the past 40 years. A major shift in cropping pattern from rice to coconut farming is mainly attributed to deficit in labour available in these regions. Because of the available good water resource coupled with adequate crop care, coconut was found to be very economical to all the farmers in the region, which accelerated area wide expansion in no time.

Table 1. Area and production of coconut in the Gaja affected regions of Tamil Nadu (2016-17)

Name of the district	Coconut area (Ha)	Production (lakh nuts)	Productivity (Nuts/ha)
Thanjavur	36,136	6639	18372
Thiruvarur	4718	870	18440
Pudukottai	9456	1121	11855
Nagapatinam	3823	654	17104
Tiruchirapalli	6070	465	7661
Average productivity/ha	14,686 nuts		
Average productivity/palm	84/palm		

Source: Coconut Development Board

In the predominant Gaja affected areas of Thanjavur, Thiruvarur, Pudukkottai and Nagapatinam, the average nut productivity is found to be very higher (84 nuts /palm/year). Among the Gaja affected regions, coconut is predominantly cultivated in Thanjavur district and the loss incurred to the crop is also very high in the region.

General observations

The team visited different villages of the cyclone Gaja affected regions and then took stock of the hefty crop loss damage. The scene was unimaginable as the sturdy crop like coconut, an ecological service provider of the coastal region worldwide was also badly damaged.

a) In the affected gardens, coconut palms were either uprooted, broken at the bole region, trunk twisted and broken off if damaged by disease or any mechanical injury, extensive twisting of crown with irrecoverable damage, crown congestion with arrest of emergence of spear leaf, partially uprooted slanting palms.

b) Juvenile palms were also twisted and become slanted by partially uprooting and in many cases the crown was badly damaged

c) Affected fields were full of fallen tree trunks and deteriorating crowns and the scene is disheartening and heartbreaking.

d) Surviving palms are also badly damaged by the sheer force of cyclonic storm resulting in nut and button fall.

e) All the dicot tress enroute Gaja was jolted by the storm with complete detachment from soil resulting in complete drying of border trees and homestead trees such as Jack in Pudukkottai district

f) The worried and bleak faces of farmers including the farm women had in fact touched hearts of the scientific team expressing their helplessness and magnanimous support seeking livelihood revival.

g) Other crops such as oil palm, maize, sugarcane were also damaged in the region

Impact of Gaja on Coconut

a) ***Uprooting of palms:*** Due to the heavy velocity (115 kmph) of the cyclonic storm Gaja, the palms along the windward side had been completely uprooted which cannot be revived. The uprooted palms are fallen on the ground.

b) ***Trunk breakage:*** In the affected gardens many of the palms were also broken at the trunk region which were constricted by moisture stress during earlier years or at weakened spots due to damage by pests and diseases such as rhinoceros beetle damage, basal stem rot disease, etc

c) B***reakage at bole region:*** Palms that are exposed in the bole region with inappropriate earthing up, are broken off at the collar region and are completely detached from the root system.

d) ***Terminal region blown off*** : The terminal region of certain affected palms were blown away by the high velocity wind

e) ***Semi-circular breakage of terminal region:*** Due to the impact of the wind and the ability of the palm to withstand the partial pressure of swirling wind, a part of the crown region is broken off.

f) ***Crown twisting of palms:*** The crown had been twisted especially in the juvenile palms with reduced crown weight

In vast majority of the coconut palms, where the bole with roots was visible above the ground, the coconut palms were observed to have been broken at the base of the bole, resulting in toppling of the entire palm. In addition, breakage of the stem was observed in a few coconut palms, in the affected plantations. Closer observation of the broken trunks revealed that the these palms had been affected earlier by pest and disease problems, resulting in scarring/ damage of the stem and under wind-induced stress, the stems tended to break at these particular weak points, resulting in toppling of the crown. Since the coconut stem has no cambium, damaged tissues of the stem are not regenerated and in the presence of physical damage to the coconut trunk, such coconut palms cannot withstand the stress of high velocity cyclone winds. However, irrespective of the type of planting and soil conditions, a few coconut palms appear to have withstood and survived the havoc caused by high velocity winds and stand testimony to the ability of coconut palms to survive high intensity cyclones accompanied by high velocity winds. In such of the retained palms, varying levels of damage to the crown, ranging from bruising of the leaves, petiole breakage, spindle leaf breakage to severe tearing of leaves, various levels of defoliation were observed. This can be attributed to the phyllotaxy of the coconut leaves, facilitating passage of high wind velocity prevailing during cyclone through the canopy, and escaping complete detopping and death of the palms.

Recommendations

a) Removal of debris

The fallen crown and trunk region should be immediately disposed off. The coconut leaves can be processed for composting and can also be used as mulch in the surviving palms. However, the crown portion after defoliation inclusive of trunk could be buried to avoid insect attraction.

b) Caring the injured palms that are recoverable

The palms that are injured and distorted which are likely to recover immediately may be protected by application of Bordeaux paste 10% so that secondary pathogens and other pests do not gain entry. In addition, health of such injured palms may be improved by supplementation with 50% dose of recommended fertilizers along with need-based micronutrients. Crown twisted juvenile palms shall be made upright and applied with Bordeaux paste at injured site.

c) Raising of short duration pulses/vegetables

In order to have a continuous flow of income which is presently affected by the palm loss, short duration pulses/vegetables should be cultivated at the earliest utilization the available water resources. The compost generated from palm leaves could also be used as manure.

d) Decentralized farmer participatory seedling production initiative

The need for coconut seedlings in the affected region is very enormous and supply from external agencies is a haunting task and is practically not feasible to mobilize quality coconut seedlings from far off places immediately. In order to tide over this task, a decentralized farmer participatory seedling production initiative is suggested by identification of suitable mother palms that are wind tolerant, healthy and disease-free, high-yielding in the immediate vicinity. Collection of seed nuts from such identified mother palms should be started from December-January onwards so that good quality

planting materials are made available for planting in the coming season during September-October 2019. ICAR-CPCRI in collaboration with AICRP in Palms and Department of Agriculture, KVK can empower the identified farmer groups for raising coconut nursery.

e) Establishment of wind break system

Wind break system by planting palmyrah and casurina should be invariably undertaken at all entry of points of cyclonic path in a social participatory mode taking ecology as well as environment safety as prime factors so as to reduce the impact of wind velocity in case of future natural fury by such cyclonic storm

f) Scientific coconut rejuvenation

While taking up new planting, deeper pits (1.0 m3) may be dug out for ensuring deep planting of coconut seedlings. After digging out pits of dimension 1 m x 1 m x 1 m, it shall be filled up with top soil to a height of 50 cm. The coconut seedlings are then planted in the centre of the pit by making small hole within the pits and the soil around the seedlings must be firmly pressed. Care should be taken so that the collar region of the seedlings is not filled up with soil in the planting process. Ensure slow filling of pits to facilitate vertical and horizontal penetration of roots for better anchorage and withstand wind pressure in future. After first year of planting, pits should be widened by scraping the soil around the pit with 1 m radius so that depth from surface of pit to the seedling collar region is 40 cm. In the second year, widening should be made to a radius of 1.5 m and the soil should be covered to fill the pit, leaving 30 cm from the top. Similarly third year after planting, basins should be widened to form a circular basin with a radius of 2m and to a depth of 20 cm. In regions having high water table, planting of seedlings on mounds (at least 1 m height) formed by using the top soil excavated while making trenches is recommended.

g) Wider spacing

In cyclone prone areas, a wider spacing of at least 10 x 10 m is recommended for easy flow of wind during cyclonic storm by providing adequate leeway. This will encourage spaces for intercrops suitable for the region with crop pluralism strategy "an inch of land with a bunch of crops" making the system holistic, inclusive and providing continuous income and employment.

h) Viable Crop insurance

A viable crop insurance scheme has to be

implemented to ensure security in terms of any insurgency encountered. The existing insurance offered in this sector is very meager which needs enhancement to meet out any such disaster in future.

i) Pest and disease management

Besides complete crop loss encountered, the fallen palm trunks as well as the deteriorating palm crown would incite damage by rhinoceros beetle (*Oryctes rhinoceros*) and red palm weevil (*Rhynchophorus ferrugineus*), respectively. Aftermath of Gaja cyclonic storm, the two key pests infesting coconut palms viz., rhinoceros beetle and red palm weevil could invariably shoot up due to the available food source in the region mainly the fallen palm trunk and the deteriorating crown of palms. Close scrutiny and sustained surveillance is very critical to subdue the pest infestation in the affected region. ICAR-CPCRI has evolved effective management strategies to combat any pest outbreak in the region.

Rhinoceros beetle (*Oryctes rhinoceros*)

Adult black beetle prefers the fallen coconut trunk in the affected region for egg laying as grubs feed on the decaying organic debris and coconut logs are one of the most favoured hosts. With enormous quantum of fallen palm trunk available in the cyclone affected region, a likely outbreak of rhinoceros beetle population is imminent. The decaying palm trunk would invariably attract the black beetles for oviposition in the region. Immature stages of the pest is thus a composter and adult beetles feed on the spear leaves.

Management

1) Surviving tall as well as juvenile palms should be given prophylactic leaf axil treatment on top most three leaf axils with neem cake admixed with sand to keep away from the rhinoceros beetle incursion.

2) Injured palm trunks should be applied with coal tar or Bordeaux paste 10% to avoid secondary infection.

3) Juvenile palms can be shielded with fish net on the spear leaf region for avoiding the entry of black beetle into the leaf axils.

4) Application of Green muscardine fungus, *Metarhizium anisopliae* @ 5 x 1011 / m3 on the fallen palm trunks to induce epizootics in the developing grubs of rhinoceros beetle and this forms one of the eco-friendly approaches which can be successfully implemented through farmer-participatory community mode.

Red palm weevil (*Rhynchophorus ferrugineus*)

The palm crowns that were irreversibly damaged in the cyclone mainly in the deteriorating phase at this point of time would attract egg laying by red palm weevil. Such crowns would therefore become a good breeding place for the weevils. This should be strictly monitored.

Management

1) Collection and destruction of palm crown by pouring kerosene to kill any live stages inside and enhance composting.

2) Taking a big pit and burying the deteriorating palm crown using a JCB so as to upkeep the farm hygiene and reducing palm odour cues.

3) Surviving palms with any injury or red palm weevil infested palms should be treated with indoxocarb @ 2.5 ml per litre to kill the immature stages of the pest immediately.

4) Encourage crop pluralism and stimulo-deterrant approach in rejuvenation with perfect geometry in homesteads

Basal stem rot disease *(Ganoderma sp.)*

Palm injury would also aggravate the incidences of basal stem rot disease which is very common in the region. Some precautions need to be made to prevent further spread of the disease in the region. These brownish patches on the stem may extend up to one metre from ground level and at times bark pealing was also observed. Sometimes fruiting

bodies (basidiocarp) of the pathogen develop from the affected trunk.

Management

- Avoid burning of trash and palm residues near the trunk to avoid trunk/root injury
- Removal of dead palms and palms in advanced stage of the disease as well as destruction of the boles and root bits of the diseased palms to remove disease inoculums.
- Isolation of neighboring healthy palms, by digging isolation trenches (60 cm deep and 30 cm wide) around the affected palm (1.2 m away from the base of the trunk).
- Application of neem cake (5 kg) fortified with Trichoderma harzianum (CPTD 28) talc formulation (50 g) per palm per year at six monthly intervals reduced the disease intensity.
- Root feeding of hexaconazole @ 2% (100 ml solution per palm) and soil drenching with 0.2 % hexaconazole or with 40 l of 1% Bordeaux mixture in the coconut basin are recommended

Sustained monitoring and prophylactic treatments would suppress the damage potential of pest and disease and suitable health management strategies need to be adopted at the appropriate time for the surviving palms in the cyclone affected region. ■