

# CREATING RESILIENT AGRICULTURAL DRONE ECO-SYSTEM IN INDIA – ACHIEVEMENTS AND FUTURE ACTION PLAN

## UAV'S/Drones in Indian Agriculture:

THE CRUX IS TO DEVELOP MAKE IN INDIA MULTI-UTILITY AGRICULTURAL DRONE & CREATION OF AGRICULTURAL DRONE PILOT HUMAN RESOURCES IN INDIA WITH WELL KNITTED AGRI-DRONE PILOT CURRICULUM IN LINES WITH DGCA.

Agriculture continues to be a powerful engine for rural prosperity, economic growth and social transformation world over and especially for the developing countries. In India, agriculture holds critical importance to the economy as in the developing world as 40% - 70% of the population of these directly depends on farm sector for its livelihood and sustenance. In India, 70% of the population depends on Agriculture. Agriculture in India and globally is undergoing a rapid transformation post WTO regime, governing the global trade in

Authored by-

**Dr. Adala Vishnuvardhan Reddy**  
Hon'ble Vice-Chancellor,  
ANGRAU



food and agriculture.

Precision agriculture is an emerging trend in farm management globally, and India cannot afford to be an outlier. World population is expected to grow from 7.7 billion in 2020 to 8.5 billion in 2030, according to OECD-FAO Agricultural Outlook 2021-2030. This means the world will need more food. In India, 5 million tonnes of food grain have to be added to the national food basket every year for the next decade to feed its growing population, according to the agriculture department's estimate. India's total food grain production was 275 MT in 2017-18, says the department's latest annual report.



**ANGRAU, 1st Agri.University in India to start it's own Drone Assembling Unit and R&D Wing**  
02.12.2020

Drones have flown into India's fields pretty fast to revolutionize it's agricultural sector and to reduce drudgery in the farming. It is a great pride that Govt. of India has given due impetus to create and accelerate the drone ecosystem in India. Agriculture sector being a largest potential beneficiary of drone technology in spraying of pesticides, fertilisers, dispensing of seeds and farm scouting for crop health, soil health and to scout for many other biotic and abiotic stresses which causes huge economic damage to the farmer, so as to address them well before they become epidemic.

Agricultural drone technology is an inevitable option, which offers a sustainable solution to the acute labour shortage menace in Indian

agriculture, especially for crop protection and fertilizer application, direct seed sowing and crop, soil and waterbodies scouting to gear up Indian agriculture towards sustainable precision agriculture. Imparting both drone piloting skill set, assembling, repairs and maintenance knowledge along with crop specific SOP's for drone applications is the need of high order for the Nation. The existing methods of plant protection using knapsack sprayers and manned motorised and tractor operated sprayings are hazardous to the human health and consumes more pesticides to control the pests and diseases. These issues can be evaded by deploying drone technology in agriculture.

To keep Indian Agriculture ready to accommodate the most advanced and highly useful technology solutions like Drone technology, a resilient policy and curriculum for agricultural drone pilot training either embedded into Indian Agricultural education system at Diploma level courses and graduate level courses is a must. Creation of Agricultural Drone ecosystem in India becomes a reality with vibrant Indian agricultural drone manufacturing and highly proficient and vast RPTO network through State Agricultural Universities and ICAR Institutes is going to be inevitable. The Government of India through DGCA (Director General Civil Aviation) should gear for authorizing these state run RPTO's at the earliest possible by even identifying Acharya N G Ranga Agricultural University as a Nodal agency for creating a proficient Agricultural Drone RPTO network across India.



**Visit of Prof. Ramesh Chand,  
NITI AYOJ  
on 22.07.2022**

Drone/Unmanned spraying of pesticides and plant nutrients is a blessing for the farmers which definitely will reduce their drudgery, saves 90% of time, reduces 25-30% pesticide consumption, saves 90% water used for pesticide spraying and saves health and lives of the farmers, in addition to the obvious benefits of effective, efficient, timely, uniform spraying, easy reach to the inaccessible field locations, operations on slopy fields. It becomes easy to control the outbreaks of agricultural pandemics to safeguard the crop. This is practiced in various countries (both developed and developing countries) like USA, EU, China, Japan, Taiwan etc. and controls on use of drones in

agriculture is eased and exempted to greater extent. The manned motorised backpack sprayer actuates at a height of 0.6-1.0 m above crop canopy while spraying and in case of drones, it replaces the human back and flies very much within the same altitude and zones where air traffic and other weather parameters do not influence the safety and flight of the drone and hence, it can't be blanketly called as aerial spraying. Nevertheless, the control of the drone lies in the relatively static position of the pilot which enhances the control over the drone and reduces the danger / hazard to the pilot and on board human/animal beings except the objects. In addition, as long as it is flown within the crop micro climatic zone of

2.0 meters from the canopy, it will not cause induce impact to cause explosion or damage to the drone or human beings, when a standard isolation distance of the operator and other human or animal beings is followed strictly.

*The crux of creating agricultural drone eco-system in India is to create "MAKE IN INDIA AGRICULTURAL DRONE & AGRICULTURAL DRONE PILOT HUMAN RESOURCES IN INDIA ON SMALL CATEGORY DRONES (Upto 25 kg all up weight) WITH WELL KNITTED AGRI-DRONE PILOT CURRICULUM IN LINES WITH DGCA, Ministry of Civil Aviation & Ministry of Agriculture & Farmer's Welfare SOP's for drone applications in Agriculture.*

Acharya N G Ranga Agricultural University with it's diversified Agricultural Scientific and technical work force is striving hard to bring in cheer in the lives of farmers and consumers in this country by developing high yielding varieties, various crop production and protection technologies, development and extension of farm machinery and power systems, Post-harvest and Food processing technologies in addition to supply of quality

seed to the farmers. Further, it has acquired a new expertise in Drones and artificial intelligence Applications in Agriculture. As a part of this, a dedicated project was initiated during 2018-19 in ANGRAU, i.e. APSARA Project (A.P. Sensors and Smart Applications Research in Agriculture) to usher drones and artificial intelligence applications in agriculture towards smart and precision farming. Acharya N G Ranga Agricultural University is also closely working the A.P. Drone Corporation, Govt. of Andhra Pradesh to develop standards to use drones, sensors and IoT applications in agriculture for providing pan India BIS standards, Protocols and SOP's for preparation of Policy frameworks, in addition to taking forward of this technology to the farmers. ANGRAU is also taking up development of indigenous drone solutions with comprehensive capabilities with the help of industry partners.

Acharya N G Ranga Agricultural University has completed it's agricultural drone research programme on "Performance evaluation of Agricultural drone spraying" on 10 major crops like Paddy (DSR & TPR), Blackgram, Bengalgram (Chickpea), Redgram



(Pigeonpea), Sugarcane, Maize, Sorghum, Groundnut, Cotton and Chilli tested on 110 chemical pesticides, 5 foliar nutrients, 11 types of formulations like (SC, SL, EC, WG, WP, WDG, SP, SG, ZC (CS + SC), DC and OD using its own assembled and standardized Agricultural drones (24.8 kg all up weight- small category) called "ANGRAU-PUSHPAK" drones (10 L material carrying capacity) by Centre for APSARA.

## ANGRAU FOUND FROM THEIR RESEARCH & DEVELOPMENT THAT :

1. 22 types of Drone applications are possible in Agriculture.
2. Only 10 litres /acre or 25 litres /ha spray fluid volume is sufficient for drone spraying.
3. Only 10 Litres capacity drones are suitable for Indian field conditions
4. Only 6 minutes /acre flight planning with gross time of 10 minutes/acre is optimum for any shape type fields in India.
5. Existing chemical formulations registered with CIB&RC, Govt. of India are suitable for drone spraying
6. No need for ULV (Ultra-Low Volume) formulations for drone spraying, existing formulations are enough
7. 25% reduction in pesticide dosage is possible, if sprayed with drones
8. 95% water is saved
9. Drones can be successfully used for granular fertiliser and seed dispensing, especially Direct Sowing of Rice, Sowing of Blackgram and Greengram and Green manure crops.
10. Drones can be used for spraying of Bio-formulations
11. Drone spraying greatly Reduces drift losses
12. Drone spraying greatly reduces AG non point source pollution
13. Drone Spraying is 10 times more efficient than existing spraying technology

## 23 MULTIPLE APPLICATIONS OF DRONE IN AGRICULTURE

Acharya N G Ranga Agricultural University is the first university in the country to identify the following potential areas for drones applications in Agriculture in India (ANGRAU,2020).

1. Drone for pesticides and foliar nutrient spraying
2. Drone based fertiliser application
3. Drone based seed sowing
4. Drone based life saving irrigation to the crops
5. Drone based Crop health monitoring
6. Drone based Soil health monitoring
7. Drone based Watershed monitoring
8. Drone based Waterbodies monitoring

9. Drone based Land and Water Management
10. Drone based Agro-advisory
11. Drone based Irrigation advisory
12. Drone based plant and tree enumeration
13. Drone based micro-climatic studies (within 5m altitude above ground surface)
14. Drone based phenotype studies
15. Drone based 3D mapping of agricultural fields & watersheds
16. Drone based crop pollination
17. Drone based solid waste management
18. Drone based crop residue management
19. Drone based Crop Yield Estimations - to replace Crop Cutting experiments
20. Drone based ground truthing for validating Satellite data products
21. Drone based hydro-geological studies
22. Drone based live Agro-advisory to farmers using megaphones.
23. Drone based crop loss/damage assessment



# ANGRAU ACHIEVEMENTS IN AGRICULTURAL DRONE TECHNOLOGY

ACHIEVEMENTS	DETAILS
AG. DRONE TECHNOLOGY DEVELOPMENT & STANDARDISATION	10 Crops with 110 Chemicals & 11 Formulations & 5 Foliar Nutrients
AG. DRONE TRANSFER OF TECHNOLOGY	Demonstrated to farmers in 30000 acres in A.P.
AG. DRONE TECHNOLOGY UPSCALING	Encouraged 700 Drone Entrepreneurs with ANGRAU SOP's in 4.0 Lakh acres in 26 Districts
CAPACITY BUILDING IN AG.DRONE	Agri. Diploma Students, Rural Youth, RBK Staff, Scientists, Agricultural Department Officials and other stakeholders, Startups, FPO's
BUSINESS MODELS FOR AG.DRONE	RBK based CHC and FPO based CHC and Individual Entrepreneurs
POLICY MAKING FOR AG. DRONE	National SOP's, National Drone Policy, Govt. of AP Drone Eco-System
LITERATURE DEVELOPED	Bulletins in Telugu & English, Training Manuals, Pamphlets, Articles etc., T.V. & Radio Programmes, C.Ds on Drone Farming
KNOWLEDGE SHARING	With Farmers, R&D Institutions in India and all other stakeholders



**Smt. Poonam Malakondaiah, IAS, Spl. CS, Agriculture & Co-Operation, Visit to ANGRAU Drone Research Fields**

## SALIENT ACHIEVEMENTS OF ANGRAU IN DRONE RESEARCH

- ✓ Started its own Kisan Drone RPTO in India - The First SAU to start
- ✓ Tested 11 types of Pesticide formulations : SC, SL, EC, WG, WP, WDG, SP, SG, ZC (CS +SC), DC and OD
- ✓ Started - The First SAU to start its own Kisan Drone Production line in India
- ✓ Evaluated Drone Performance on 10 Crops : (Paddy (DSR & TPR), Blackgram, Bengalgram (Chickpea), Redgram (Pigeonpea), Sugarcane, Maize, Sorghum, Groundnut, Cotton and Chilli)
- ✓ Developed Crop Specific SOP's for Drone Spraying in 10 Major Crops
- ✓ Built ANGRAU-PUSHPAK Drone model and standardised for Spraying and Fertiliser/Seed dispensing
- ✓ Proved that 25% pesticide reduction in recommended doses is possible with drone spraying
- ✓ Tested 110 Pesticides + 5 Foliar Nutrients + 2 Granular Fertilisers + 5 crop seeds for sowing
- ✓ Designed exemplary 15 days Curriculum for Agricultural Drone Pilot Training Course By ANGRAU

ANGRAU, the first State Agricultural University (SAU) in the country to generate crop specific SOP's for 10 major crops and with its vibrant experience and expertise developed in drones applications in Agriculture, with high level of academic cognizance, it has designed proficient Agricultural Drone Pilot training curriculum in line with DGCA curriculum, which includes

1. Theory (Drone + Agriculture)
2. Laboratory Work (Assembling, disassembling, software tuning, calibration, testing, repairs and maintenance)
3. Simulator Training & Testing and
4. Field training (With instructor and Solo flying) in real-time conditions

which includes Regulations of DGCA, CAR regulations with updates, basic principles of flight, ATC Procedures & Radio Telephony, Fixed wing operations and aerodynamics, Multirotor components and operations, weather and meteorology, hands on agricultural drone assembling – Small category, Drone equipment maintenance, emergency identification and handling, payloads, Image video interpretation, drone flight simulator training and testing, practical flying at different heights, speeds matching the parameters for

agricultural operations in different crops with various hover movements, mission planning, mapping in different ways, practical flying & solo flying under the supervision of RPAS instructor and without RPAS instructor with and without obstacles, Agricultural aspects of drone applications, SOP's for drone operation, solo flying in real-time conditions etc. and assessment.

Such SAU RPTO's should breed the sub-RPTO's in their respective states in PPP (Public-Private Partnership) mode and incubate them to be the proficient and successful trainers of Agricultural Drones. This assures drone training quality and training price control – a kind of mixed economic model, which is in lines with the basic nature of Indian economy, i.e., through healthy competition, goods & services quality and price is controlled.

The infrastructure (Lodging, boarding, training drones, trainees, simulators and field area for practical flying sessions etc.) required for RPTO should have a minimum capacity to accommodate atleast 20 members per batch @ 5-10 small drones for training @ 1 drone / 2-4 trainees with 4-7 sets of batteries in circulation per batch.

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