

DRONE TECHNOLOGY USE IN GROUNDNUT AT ICAR-DGR

Drone technology and the use of drones i.e., unmanned aerial vehicles (UAVs) has been received the most attention in the industry over the years due to its versatility and potential for the agricultural sector.

What role do drones play in Indian agriculture?

Drones make easy of agricultural operation/activities/decision making and profit greatly from precision agriculture in addition to improving overall performance. Some applications are as follows:

1. Field and soil analysis:

Measures soil moisture, terrain, soil conditions, soil erosion, soil nutrient concentration, and soil fertility.

2. Monitoring the crops

- Identifying bacterial/fungal diseases in the early stages of the crop are critical.
- Create multi-spectral images that track crop health.
- The drones with multi-spectral or RGB sensors can detect the areas in fields infested with weeds, diseases and pests.

3. Monitoring irrigation:

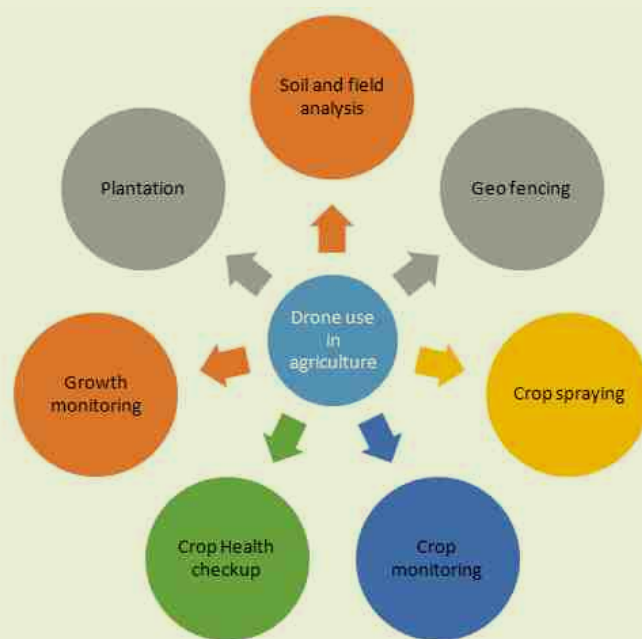
Drones consisting of thermal, hyper spectral or multi-spectral sensors, help identify the areas which are torrid and needs the attention of farmers. This survey by drones helps in improving the water efficiency and disclosing the pooling/leaks in irrigation, calculates the vegetation index for realizing the crop health and heat/ energy emitted.

4. Spraying of pesticides :

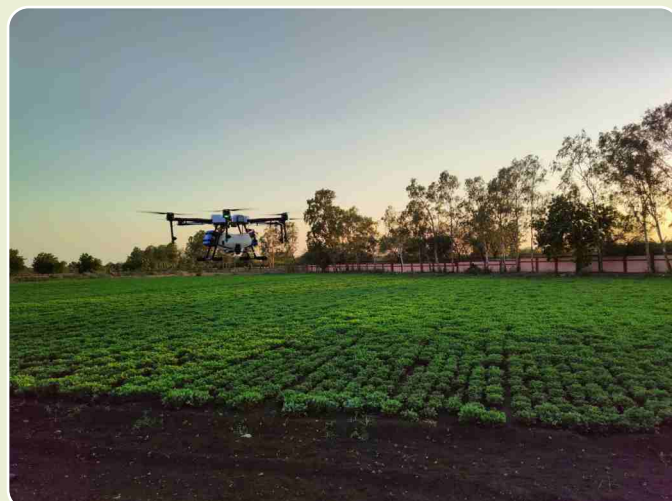
Useful in spraying of pesticides /insecticides in precision in less time.

5. Tracking livestock:

Track the movements of cattle through drone survey and can locate animals and their illnesses or injuries using thermal sensor technology.



Role of Drones in Agriculture



Agri-drone and its use at ICAR-DGR, Junagadh

CHECKLIST FOR DRONE OPERATION		
<ul style="list-style-type: none"> • Check the weather • Check rules and regulation • Firm ware updated • Area survey and obstacle checked • Flight route/area planned 	<ul style="list-style-type: none"> • Shortlist story board/mission plan • Controller charged • App updated SD card formatted • Aircraft battery charged 	<ul style="list-style-type: none"> • All equipment brought • Propellers Tighten and free to move • Battery correct temperature • Gimbal Cap removed • Double check for obstacles • Check for satellite strength
<ul style="list-style-type: none"> • Warn all spectators • Correct flight mode selected • Lens covered removed • Insert SD card in aircraft • Check for signal strength • Home point set 	<ul style="list-style-type: none"> • Inspect aircraft for faults • Compass calibrated • Battery properly fitted • Check for wind speed • Check for antenna output • First aid kit packed 	<ul style="list-style-type: none"> • All equipment brought • Propellers Tighten and free to move • Battery correct temperature • Gimbal Cap removed • Double check for obstacles • Check for satellite strength
IN – FLIGHT CHECKLIST		POST - FLIGHT CHECKLIST
<ul style="list-style-type: none"> • First turn on controller • Turn on aircraft • Arm controller • Hover aircraft at 15ft for 10 sec to monitor behavior of aircraft and sound • Check response of all controls 		<ul style="list-style-type: none"> • Turn off the drone then controller • Check for desired footage • Inspect drone for any damage • Fasten gimbal cover • Pack equipment and fill flight log

SOPs for Groundnut Crop as given by Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare (Mechanization and Technology Division), Krishi Bhawan, New Delhi.

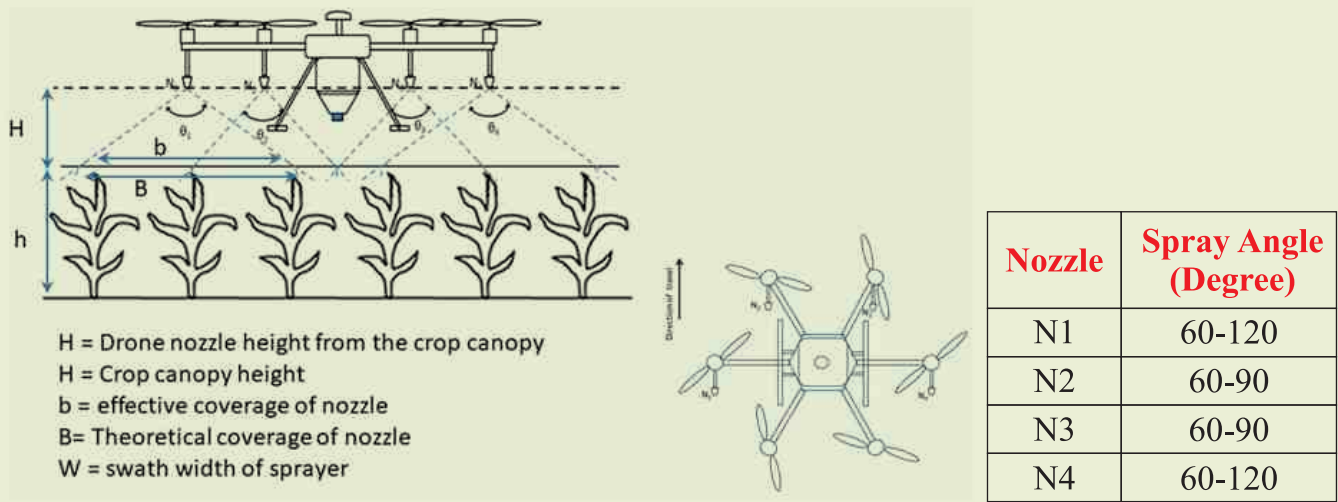
{Crop Specific Standard Operating Procedure (SOP) For The Application of Pesticides with Drones (An Extension to the generic SOP for use of drone application with pesticides for crop production and for spraying soil & crop Nutrients in Agriculture, Forestry, Non-cropped areas.)}

The SOPs for groundnut crop were given by Ministry of Agriculture and Farmers Welfare Department of Agriculture and Farmers Welfare (Mechanization and Technology Division) Krishi Bhawan, New Delhi. The SOPs are mainly based on drone parameters (drone flying speed, height of drone above the crop canopy), sprayer parameters (nozzle and swath characteristics), crop parameters (crop canopy volume, crop growth stages, water volume per hectare, pesticide concentration and dosage, suitable time of spray), weather conditions (temperature, humidity, wind speed) as per location and climatic zone with major emphasis on optimum bioefficacy and no phytotoxicity. The crop specific SOPs developed considering a standard drone with tank capacity of 10 liters and overall drone weight less than 25 kg. The height of the drone above the crop canopy is related to overall weight of the drone, down wash effect over the crop canopy and sprayer characteristics. The drone has to fly near the crop canopy as much as possible to avoid drift during operation and to safeguard the environment. However, the drone should maintain a vertical clearance above the crop, while flying, so that the thrust created by the former should not lead to lodging of the latter. Therefore, operation at optimum height is important. Similarly, the drone flight speed affects the uniformity of spray and needs to be optimized. The procedure for the selection of the drone speed and nozzle height from the crop canopy was given in the SOPs given by Government of India.



1. Drone flying speed (m/s)		6. Nozzles	
During spraying	4.5-5.0	Type (Anti drift)	Flat fan
During launch, RTL and turning	<5.5	Droplet Size (μm) for Insecticide	250-350
2. Drone height above crop canopy (m)		Droplet Size (μm) for Fungicide	250-350
Good crop conditions	1.5-2.0	Discharge rate (litre/min)	0.3-0.6
Varieties/ conditions prone to lodging	2.0-2.5	Angle (Degree)	60-120
3. Water volume (l/ha)		Swath(m)	3-6
Stage-1 : Early stage	20	4-6	4-6
Stage-2: Full canopy stage	25	Pressure (bar)	2-3
4. Suitable time schedule for spray		7. Weather conditions	
Summer and rainy season:	6am- 10am	Temperature ($^{\circ}\text{C}$)	< 35 (preferably)
	3pm-6pm	Humidity (%)	> 50 (preferably)
Winter season:	8am-11am	Wind speed (m/s)	< 3
	2pm-6pm	During rain	Do not spray
*Strictly avoid spraying during flowering stage	---	If visibility during fog/mist is not good	Do not operate
5.Site Specific		8. Length of buffer zone (m) to avoid	
Plain land: Take care of obstacles present in the field	Plain land: Take care of obstacles present in the field	Non targets crops	5
Sloppy terrain: Use terrain following sensors	Sloppy terrain: Use terrain following sensors	Water bodies etc.	100

Swath at different operational heights and spray angles of nozzles



Picture Credits : Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare (Mechanization and Technology Division),KrishiBhawan, New Delhi.

Drone with nozzles below the propeller

At ICAR-DGR, two Agridrones were purchased during 2022 from Iotech Agribot® Two scientists undergone drone pilot training programme at RRU, Gandhinagar and got licensed / certified (PC0323000030L and PC0323000030P) during March, 2023. As per the SOPs given by Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare (Mechanization and Technology Division) Krishi Bhawan, New Delhi, at ICAR-DGR application of pesticides using drones is being taken up. The operational and safety measures given in SOP guidelines are being followed to ensure safe, efficient and effective use of the inputs and the drone technology.



Agricultural Drone use at ICAR-DGR Junagadh

Acknowledgment : Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare (Mechanization and Technology Division), Krishi Bhawan, New Delhi. {Crop Specific Standard Operating Procedure (SOP) For The Application of Pesticides with Drones (An Extension to the generic SOP for use of drone application with pesticides for crop production and for spraying soil & crop Nutrients in Agriculture, Forestry, Non-cropped areas.)}

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