

Potential for drone delivery of coconut leaf vermiwash (Kalpa Vermiwash) for boosting organic agriculture

Murali Gopal and Alka Gupta

Crop Production Division

ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala



Foliar fertilizer application by a drone

Drone technology in agriculture

Drone technology, i.e. unmanned aerial vehicle, is increasingly getting integrated in Indian agriculture for survey of crop coverage, disease and pest detection, assessing soil conditions; identification of nutrient deficiency in crops, application of liquid fertilizers and plant protection chemicals, yield data collection and many other aspects. Utilization of drone technology could help farmers improve their crop yields through efficient use of resources and labour.

Drone for spraying agro-chemicals

Spraying of fertilizers by drones has become a popular agronomic intervention. It is possible to apply optimum amount of liquid fertilizer at right time in short

span for large areas. The biggest advantage is precision application compared with traditional methods. This greatly prevents loss of nutrients while reducing the farmers' expenditure.

For spraying purpose, drones must i) be able to cover entire field in minimum numbers of flights, ii) have enough payload capacity to carry sufficient amounts of the liquid fertilizer to cover the area, iii) a high-pressure spraying system and if possible iv) wide-angle camera to capture high-resolution images and videos, and v) GPS navigation system for precise application of the fertilizer. Moreover, to avoid wastage of the liquid fertilizer as drift loss, having information on weather factors such as wind speed and direction will be helpful to command the drone for precision application. In order to use drone efficiently, models with integrated

variable spray system driven by artificial neural network have been developed. These models have software embedded in the drone that regulates the flow rate, and accordingly the deposition rate deposition on target surface. To reduce falling of sprays on non-target areas, modular anti-drift nozzles can be used. Further, the mechanical, electric and electronic components could be altered as per requirements.

Spraying drones are used for application of different agro-chemicals on crops. One among them is foliar fertilization. It is particularly useful if the soil conditions do not allow efficient supply of nutrients due to inherent soil factors, inability of crops to absorb nutrients due to poor rooting or stage of crop when quick uptake of nutrient is required that can be facilitated by foliar absorption etc.

Organic agriculture in India

With Organic Farming being one of the National Priorities in agriculture, farmers will require multiple approaches to adopt this farming system. As per APEDA, the area under organic certification (registered under National Programme on Organic Farming) in India during 2021-22 is 9119865.91 ha that includes close to 50% as cultivable area and rest from wild harvest collection. States having highest area under organic farming are Madhya Pradesh, Maharashtra, Gujarat, Rajasthan, Odisha, Karnataka, Uttarakhand, Sikkim, Chhattisgarh, Uttar Pradesh and Jharkhand. The production of organically certified outputs was at 3430735.65 MT during 2021-22 that included several

food and fibre produce. Through export of 460320.40 MT of organic products, India could earn Rs. 5249.32 crores. (https://apeda.gov.in/apedawebsite/organic/organic_products.htm#:~:text=As%20on%2031st%20March%202022,ha%20for%20wild%20harvest%20collection)

Status of organic manure production

Organic agriculture is driven by the theme of promoting soil health in ecologically safe manner. Use of chemically synthesized fertilizers and pesticides is avoided as far as possible. Application of fertilizers in fields such as farm yard manure, composts/vermicomposts, de-oiled cake, plant-based pesticides, seaweed fertilizers and bioinoculants form the main inputs in organic farming. These are soil-based interventions. The quantum of organic manure and bioinoculants produced in India during 2020-21, as per NCOF (<https://ncof.dacnet.nic.in/StatusOrganicFarming>), was around 42940832 MT. In this, the liquid biofertilizer was to the tune of 42239 KL. The innovation of drone technology in agriculture can be now harnessed for aerial application of organic fertilizers in liquid form.

Coconut leaf vermiwash: an earthworm-worked liquid organic fertilizer

ICAR-CPCRI has developed a technology of producing liquid organic fertilizer from coconut leaf vermicomposting technology. The Coconut leaf vermiwash (CLV), branded Kalpa Vermiwash, is a clear-



Coconut leaf vermiwash (Kalpa Vermiwash) produced in plastic barrel or mud pot

brown colour liquid extracted from barrels filled with pre-decomposed coconut leaf mixed with cow dung and mature coconut leaf vermicompost in fixed ratio which is being actively decomposed by earthworms. CLV is alkaline in property and contains all necessary plant nutrients including plant growth promoting hormones and humic acid. It also contains good population of plant-beneficial microbiota, particularly, fluorescent pseudomonads. The liquid is diluted with water and applied as soil or foliar spray.

Studies in Institute and farmers fields have clearly shown that application of CLV promotes yield of tomatoes, okra, green leafy vegetables and maize. It also promotes microbial communities that improve soil health including *Trichoderma* spp. and enzyme activities in soil that aid in improving soil health and fertility. Farmers who adopted this technology have noted that application of CLV promoted luxurious growth of fine roots and hairs in green leafy vegetable crops and improved the keeping quality of the harvested leafy vegetable products.

Demonstration trials in farmers' plots with manual spraying appropriately diluted CLV on foliage of amaranthus and cowpea plants in farmers had shown to promote the growth of the vegetable crop. In addition,



Amaranthus with profuse production of fine root hairs in the vermivash treated (manually) plots at farmers' field in Kasaragod

the vermivash also promoted epiphytic microbial population and activity that could increase the plant health through enhanced absorption of nutrients and microbial metabolites. Further, since CLV is an organic fertilizer made without the use of any synthetic chemicals, it will not contaminate soils or water bodies or cause harm to any organisms or living beings.

Coconut leaf vermivash as drone spray

Coconut leaf vermivash is an earthworm-processed organic liquid fertilizer produced from vermicomposting unit. It contains a wide range of essential nutrients, including nitrogen, phosphorus, potassium, magnesium, zinc, iron as well as plant growth promoting hormones and humic acid. These nutrients are essential for plant growth and development which can be applied as foliar spray to supplement nutrient requirements of plants. By providing essential nutrients to plants, foliar sprays can help them to grow faster, stronger and healthier and become an important component in boosting organic agriculture.

References

- Huang, Y., Hoffmann, W.C., Lan, Y., Wu, W and Fritz, B.K. 2015. Development of a spray system for an unmanned aerial vehicle platform. *Appl. Engg. Agrl*, 25(6):803-809
- Pathak, H., Kumar, G.A.K., Mohapatra, S.D., Gaikwad, B.B. and Rane J. 2020. Use of drones in Agriculture: Potentials, Problems and Policy Needs, Publ. no. 300, ICAR-NIASM, pp 13+iv.
- Puri, V., Nayyar, A and Raja, L. 2017. Agriculture drones: A modern breakthrough in precision agriculture. *Journal of Statistics and Management Systems*, 20:4, 507-518
- Shaw, K.K. and Vimalkumar, R. 2020. Design and development of a drone for spraying pesticides, fertilizers and disinfectants. *Int. J. Engg. Res. Technol.(IJERT)*, 9 (5): 1181-1185
- Gopal, M., Gupta, A., Palaniswami, C., Dhanapal, R and Thomas, G. V. 2010. Coconut leaf vermivash: a bio-liquid from coconut leaf vermicompost for improving the crop production capacities of soil. *Current Science*, 98:1202-1210
- Gopal, M., Gupta, A., Rayudu, B.T. and Thomas, G.V. 2010. Coconut leaf vermivash for soil health improvement and Quality yield of vegetable crops – Validation in farmers' fields. In Singh, H.P. and Thomas, G.V, *Organic Horticulture: Principles, Practice and Technologies* (eds). Westville Publishing House, New Delhi, India, pp 223-229
- Gopal, M., Gupta, A and Thomas, G.V. 2012. Coconut leaf vermivash as a component of organic farming to sustain soil health and fertility. *Int. J. Coconut Res. Development (CORD)*, 28(1): 34-42.
- Gopal, M., Gupta, A. and Thomas, G.V. 2012. Vermicompost and vermivash add beneficial micro flora that enhance soil quality and sustain crop growth. *Intl. J. Innov. Hort.* 1:93-100