



Unmanned technologies in horticulture and vegetable growing: types of drones, benefits of imaging and application with drones

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DroneUA. ABOUT US

- First place in the Ukrainian agricultural robotics market
- Own development of IT and GIS products
- Own import of specialized database services
- The largest distributor of XAG robotics in Europe
- Over 100 employees
- The Ukrainian market of spraying drones was № 1 in Europe in 2022!





UKRAINE SETS TRENDS





Ukraine ranks 1st in the world in terms of usage of spraying drones in 2022.

Ukraine is № 1 in the European market in 2022.

- The largest fleet of agricultural drones in Europe more than 1,500 spraying drones.
- In 2021 1 million hectares of land was treated with agricultural drones; in 2022 - 1.2 million hectares, despite all the difficulties.
- Active growth of the service businesses that apply plant protection products with agricultural drones more than 100 companies.
- The world's first startup to support and optimize the market for drone spraying services has been established in the midst of war.





THE OVERALL EFFECT OF USING DRONES IN AGRICULTUR fifuture UKRAINE, 2021-2022







WAYS OF USING DRONES IN AGRICULTURE

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Applying plant protection products and Agricultural monitoring, scouting, fertilizers mapping **Fixed-wing flight Multi-rotor** platforms Aerial multi-rotor **Unmanned** ground spraying drones vehicle **Airplane type Multi-rotor Aerial multi-rotor spraying Unmanned ground** drones vehicle





AGRICULTURAL MONITORING

- Visual inspection of orchards or fields based on an orthophoto plan
- Monitoring of plants, their conditions
- Field measurement and farms certification
- Creation of plants development maps based on the vegetation index NDVI,
 NDRE
- Creating maps of differential application of crop protection means and liquid

fertilizers

• Other.

Food and Agriculture Organization of the United Nations





DRONES ARE THE TOOLS FOR RAPID DATA COLLECTION ON THE PLANTATIONS CONDITIONS. IMPORTANT! DATA PROCESSING AND ANALYSIS IS THE MOST IMPORTANT STAGE THAT FACILITATES DECISION-MAKING





SCOUTING AND ANALYSIS. CASE

Objective: to assess the condition of trees after the last foliar nitrogen application

Object Description: plum orchard, total plantation area - 12.4 hectares

Geography: Magenheimer Farms, Prune Farm, South Yuba City, California



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SCOUTING AND ANALYSIS. CASE

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Objective: to conduct drone mapping to assess the field's potassium supply and build a map of differential fertilizer application

Object Description: carrot field, 10 hectares

Geography: Netherlands





SCOUTING AND ANALYSIS. CASE

Objective 1: to conduct a multispectral analysis of the vineyard to assess the condition of the irrigation system

Object: grape plantations, 15 hectares

Geography: Florence, Italy



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NDVI

High Vigor









CLASSIFICATION OF AGRICULTURAL DRONES

An agricultural drone/spraying drone is an unmanned vehicle used to apply a wide range of pesticides (liquid water solutions of plant protection products, fertilizers and growth regulators), spread granular pesticides or seed material, and also for mapping.



Multi-rotor Agricultural drone XAG P100 for applying solutions



Multi-rotor Agricultural drone XAG P100 for applying bulk materials



Ground spraying drone XAG R150







XAG RevoTerra



















10 l/min

total productivity 18 ha/hour

maximum spraying width 10 m











ROBOTIC PLATFORM XAG R150 Vertical swings Horizontal swings 200° 290° Max. angle Max.angle 360° 180° Max. angular Max. angle velocity

Built-in gyroscope sprayer automatically maintains spray angle for more precise spot spraying and 360-degree coverage agrifuture









ADVANTAGES OF USING SPRAYING DRONES

- **up to 95% water savings:** about 5 liters of working solution is required for pesticide application per 1 ha, that ensures significant water savings;
- up to 90% fuel savings: 20 times less fuel consumption compared to trailed and self-propelled sprayers;
- **up to 30% savings of pesticides:** ultra-small droplet size of the solution and application of plant protection products with an accuracy of 2 cm significantly increases the absorption of the material;
- **zero damage:** no tramlines and no damage to high plants;
- **no downtime:** work in the field after rain, at night, with safety for bees; the team can process 1000 km per day;
- **mobile and efficient:** 1 working team of a service company includes a drone operator, an assistant, a car, 2-3 drones; 1 shift productivity of an aerial drone is up to 350 hectares, of unmanned ground vehicle up to 50 ha (productivity of one drone is up to 5 hectares per hour depending on the type of crop, plantations).





EFFICIENCY OF AGRICULTURAL DRONES USAGE CASE «ORGANIC BLUEBERRY, FAMILY GARDEN FARM», UKRAINE



Operating parameters:

- Area: 130 hectares
- Time period: April 11-14, 2022
- Equipment: XAG V40 drone 1 working kit
- Team: Drone operator + assistant
- Work duration 3 work shifts (3 days)



Органічна лохина: українська компанія, яка пережила окупацію, відновила експорт до ЄС

/ Агроновини / Понеділок, 03 жовтня 2022 12:38

Цього року компанія Family Garden із Київської області зібрала близько 500 тонн лохини, 80% з якої було відправлено на експорт. Підприємство вирощує ягоду на 155 га, це одна з найбільших плантацій органічної лохини в Європі. Основні ринки – країни ЄС (Данія, Нідерланди, Німеччина, Іспанія).

Organic blueberry: Ukrainian company that survived the occupation resumes exports to the EU





SUMMARY ON BIOFUNGICIDE APPLICATION FOR BLUEBERRY

Part 1

Technique	Spraying drone XAG V40 - 1 item	Tractor Lovol ft 504 and trailed sprayer Vesuvius type 600 liters	Effectiveness, comparison of agriculture drone and tractor + sprayer
application of the working solution	6 l/ha	400 l/ha	water saving
per 130 ha	780 l / 0,78 cubic meters	52 000 l / 53 cubic meters	51 220 l
product application	2 l/ha	2 l/ha	no difference
fuel consumption	up to 30 l *	390 I*	fuel saving
per 130 hectares	30 * 48 UAH/I = 1 440 UAH	390 * 48 UAH/I = 18 720 UAH	360 I 17 280 UAH
	*an average of 150-300 ml of fuel is used to charge 1 battery	*fuel consumption per 1 work shift with a working area of 10 hectares + transportation to the field is around 30 liters	





SUMMARY ON BIOFUNGICIDE APPLICATION FOR BLUEBERRY

Part 2

Technique	Spraying drone XAG V40 - 1 item	Tractor Lovol ft 504 and trailed sprayer Vesuvius type 600 liters	Effectiveness, comparison of agriculture drone and tractor + sprayer
productivity rate of 1 shift	45 ha/shift	10 ha/shift	4.5 times more productive
water logistics for 130 hectares	221 UAH 780 I	14 729,00 UAH 52 000 I	14 508 UAH
0.28 uah/l per 1 ha			
duration of work 130 hectares	3 work shifts	13 work shifts	reduced by 10 work shifts
labor remuneration	4 500 UAH * *average wage of the operator starts from 1500 UAH/shift	13 000 UAH * *average rate for 1 working shift starts from 1000 UAH	9 500 UAH
The cost of a technical operation	1 440+4500+221 = 6161 UAH	18 720+13000+14729 = 46 449 UAH	Cost savings: 46 449 – 1 161 = 40 288 UAH





TECHNOLOGICAL MAP OF ORGANIC BLUEBERRY

Stage: Blooming - 1 application Microfertilizer	22 applications: when working with single-component solutions			
Stage: Emergence of peduncles - 2-4 applications				
Microfertilizers + bioinsecticide + biofungicide	17 applications:			
Stage: Before flowering - 3-5 applications Microfertilizers + bioinsecticide + biofungicide	of which 11 operations are single-component solutions, 6 operations are tank mixes			
Stage: After flowering - 3-4 applications Microfertilizers + bioinsecticide + biofungicide				
Stage: Formation, ripening of berries - 3-4 applications	Drone spraying is recommended only for one- component solutions application.			
Stage: After picking berries - 1-2 applications				
Microfertilizer + biofungicide				

Stage: Late application- 2 applications Microfertilizers





DIRECT ECONOMIC IMPACT

22 applications:

when working with single-component solutions

Total savings when using drone

22 operations* 40 288 UAH = 886 336 UAH or \$ 23,3 thousand.

17 applications:

of which 11 operations are single-component solutions, 6 operations are tank mixes

Total savings when using drone

11 operations* 40 288 UAH = **443 168 UAH or \$ 11,7** thousand The cost of a drone working kit **is up to \$24 thousand.**







ADDITIONAL ECONOMIC IMPACT

The efficiency of crop protection is higher thanks to faster application of crop protection means, which results in the increased quality and higher yield of blueberries and, consequently, in additional revenues.

1. Increase in yield

- Increase in yield by +3%
 up to 90 kg/ha with an average yield of 3 t/ha
- Additional revenue + UAH 1,2 mln at an average price of 104 UAH/kg in 2022

2. Quality improvement

- Increase of the purchase price
- •for average quality, the average price is 104 UAH/kg
- •for high quality, the average price is 117 UAH/kg
- Additional revenue + UAH 5,1 mln
- •at an average price of UAH 40.8 million,
- •at the average price of higher quality -UAH 45.9 million

Under these conditions, one working kit of a spraying drone (\$24 thousand) pays for itself within one agricultural season.





Thank you for your attention!

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