

# 3<sup>RD</sup> WORKSHOP ON APPLIED AND SUSTAINABLE ENGINEERING

03.06.2018 to 09.06.2018, Koszalin University of Technology, Poland

Berner B. Faculty of Mechanical Engineering, Koszalin University of Technology, Poland

## THE USE OF DRONES-MULTICOPTERS IN PRECISION AGRICULTURE

### SUMMARY

*The paper presents possibilities of using drones-multicopters as air platforms with machines mounted on them for spreading mineral fertilizers in form of granulate and dust as well as for fertilizing and feeding plants with liquid fertilizers. The possibilities of using unmanned aerial vehicles equipped with sowing and planting machines as autonomously controlled robots for work in forestry and agriculture were also presented.*

### INTRODUCTION

Fertilization, including fertilization with mineral fertilizers and sowing seeds are treatments that should be made at specific agro technical dates. Not always conditions soil, caused by frequent rain or mid-fall Field on wetlands, allow for the execution these treatments according to the calendar. Some solution the problem could be applied in such cases drones - unmanned autonomously controlled vessels air, equipped with equipment for spreading mineral fertilizers and sowing seeds. Drones are already gaining popularity with the development of precision agriculture, particularly as devices for providing status information crops thanks to flights with cameras mounted on them multispectral [2, 3]. They can also be used for spraying plants in hard-to-reach places [1]. An additional advantage of drones is the possibility moving over fields without kneading the soil, damaging it plants and without the need to use technological paths.

#### Construction of drones adapted for fertilization and sowing

The most widespread constructions of drones, which can be adapted to perform various tasks in agriculture there are multi-rotors. The advantage of them is the possibility maintaining or moving in the air in any direction with velocity independent of the ceiling work and load. They provide a platform on which they can be mounted cameras, containers for goods, as well as equipment for doing some field work, such as spraying plant, spreading in the field of different substances, including fertilizers and seeds. An example of the construction of such a set built on the needs of agriculture are sets offered by Zhuhai Yuren Agricultural Aviation [6]. The company offers two basic drone models: Grain Flyer 3WDM8-20 and Flyer 3WDM4-10. Grain Flyer 3WDM8-20 is a rotor, which together with an additional, interchangeable mounted on it is intended for exercise various application procedures on the fields.



Fig. 1. Drone Rauch Agronator

German manufacturer of fertilizer spreaders, Rauch company, proposes a device for spreading granulated mineral fertilizer and fine seeds. It is also an octocopter, but with rotors attached to eight arms [5]. Total weight of the device with the spreader is 80 kg. The lifting capacity is approx. 30 kg. Set the Agronator was named (Fig. 1)

#### Precision sowing and planting with drone

The British project is about massive a forestation in large areas [7]. password the project is "one billion trees a year". Planting technology is based mainly on the point seeding of tree seeds. Subdugulated seeds immersed in a hydro gel, containing also a bit of fertilizer and water, they are found in biodegradable closed covers. Pots with seeds fired with the help of compressed air found in the sowing apparatus, they dig into the soil for this depth so that the container opens as a result of the impact, and the plant was able to grow freely (Fig. 3). The cover protects seeds before mechanical destruction during sinking into the soil (Fig. 2). In the same way, instead of seeds, they can be placed in seedbed covers trees.



Fig. 2. Precision planting system [7]



Fig. 3. Plant sowing and development process [7]

### CONCLUSION

The drones will slowly become autonomously controlled air platforms for doing some work field by means of agricultural machinery mounted on them. The use of unmanned aerial vehicles equipped with sprayers, seeders, spreaders and planters it becomes a fact slowly. For now, these are activities that the task is to prepare the concept, promote ideas, doing preliminary research and checking the possibility of using in practice.

### LITERATURE

1. Berner B., Chojnacki J.: Zastosowanie bezzałogowych statków powietrznych do opryskiwania upraw rolniczych. Technika Rolnicza Ogrodnicza Leśna, 2017, 2, 23-25.
2. Gabriel J.L., Zarco-Tejada P.J., Lopez-Herrera P.J., Perez-Martin E., Alonso-Ayuso M., Quemada M.: Airborne and ground level sensors for monitoring nitrogen status in a maize crop. Biosystems Engineering, 2017, 160, 124-133.
3. Mazur P., Chojnacki J.: Wykorzystanie dronów do teledetekcji multispektralnej w rolnictwie precyzyjnym. Technika Rolnicza Ogrodnicza Leśna, 2017, 1, 25-27.
4. Techniques for automated planting, patentWO2016049217A4.
5. www.rauch.de.
6. www.yuren-uav.com.
7. <https://www.biocarbonengineering.com/>.
8. <https://www.cfr-innovations.com>.
9. <https://www.youtube.com/watch?v=o9ctKgqz5K8>.