

RESEARCH ON THE USE OF GYROCOPTER FOR GRANULATED CROP PROTECTION PRODUCTS ADMINISTRATION

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Abstract: *The occurred transformations in Romania's agriculture in the last few years, respectively the agricultural surfaces structures change, renders more difficult the classical aircraft's utilisation for the pest control treatments application.*

Other countries from European Union confront themselves with the same unfavourable conditions, too. This fact led to the demand of alternative solutions in order to make possible the application of treatments with crop protection products under granules form or under liquid form.

One of the proposed solutions is that of the light agricultural aircrafts' using: Hang-gliders, mini aircrafts and gyrocopters (gyroplanes), which require small sizes landing-take off runways, of below 100 meters.

This paper presents the administration tests results of the crop protection products for pest control under granules form, tests effected in Germany with the gyrocopter.

Keywords: *light agricultural aircrafts, gyrocopter, granulated crops protection products, pesticides, distribution uniformity.*

INTRODUCTION

The occurred transformations in Romania's agriculture in the last few years, respectively the agricultural surfaces structure change, renders more difficult the treatments application with utilitarian aircraft. On one hand the small surfaces don't enable the classical aero crafts utilisation, aircrafts or helicopters, on the other hand the flight runways absence close by the treatment place make these works unprofitable.

Other countries from the European Union confront themselves with the same unfavourable conditions, too, fact that led to the demand of alternative solutions in order to make possible the application of treatments with crop protection products under granules form or under liquid form.

Tests of this kind were performed both on world plane [1] and in Romania [2] with light agricultural aircrafts, which require small sizes landing-take off runways, of only 100 meters in comparison with those 500 meters necessary for the AN-2 aircraft take-off.

Thus, very good results in application of treatments by sprayings with small quantities of liquid were performed a few years ago by Bucharest SERVOPANT firm by means of a light agricultural aircraft, AEROCRAFT mini aircraft, which can take off from runways with the length of about 110 meters.

In Germany, another type of light agricultural aircraft, the gyrocopter (or gyroplane) was recently tested. The gyrocopter is an aircraft likewise with the helicopter.

MT-03 type gyrocopter (figure1) is an aircraft propelled by an airscrew locked in by an engine with a power of 73, 6 KW (100 metric horse-power) that produces an airflow, which drives the rotor situated above the fuselage. The take off routing length is included between 10 and 70 meters, the landing routing length is of about 15 meters.



Figure 1. MT-03 gyrocopter fitted out with equipment for the granules Administration.
Photo: Pape

MATERIAL AND METHOD

A MT-03 type gyrocopter was implemented with an apparatus for granules administration by centrifugal action (figure 1 and figure 2). The tank with a capacity of 60 dm³ was assembled in the place of the chair for the passenger situated behind the pilot. The centrifugal distributor with electric control (12V) was assembled between the wheels from the back of the runway train. The junction between the tank and the distributor was achieved with pipes of PVC, of current make, the type of those utilised at sewerage (figure 2).

For the granulated material distribution uniformity establishing it was used Delicia Slug & Snail Lentils product of Frunol Delicia firm utilised for snails control from the autumn rape seed and barley crops. The applied dose was of about 3,0 kilograms/hectare, respectively the recommended dose for snail control.

The dose regulation can be done both by the damper opening regulation situated at the tank base and by the velocity of flight or by the working width, respectively the distance between two passages over the parcel, modification.

The granules catching at soil was made on a white plastic tarpaulin with fuzzes in order to remove the granules impact from the impact place. The tarpaulin sizes were of 60 meters length and 1 meters width. This tarpaulin was elongated on the sportive airport runway (figure 3). The cruising altitude of the gyrocopter was of 5 meters at the velocity of 70 kilometres/hour. Altogether there were effected three flights at the distance of 18 meters.

The uniformity establishing was effected by granules counting on each square meter of the tarpaulin.



Figure 2. The centrifugal distributor for granules scattered with electric control.
 Photo: Pape

RESULTS AND DISCUSSION

The effected counts results for the three flights (T1-T3) are numerically presented in the table 1 and figure 4.

Table 1

The number of cached (scattered) on square meter

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
T 1	5	7	8	9	21	33	32	34	23	35	33	26	28	25	28	9	17	11	8
T 2	3	9	14	13	21	32	35	34	36	37	41	41	37	37	17	6	4	5	4
T 3	2	7	5	17	20	29	25	31	35	32	30	32	30	31	25	24	11	9	7
Ave- rage	3,3	7,7	9,0	13,0	21,6	31,3	30,7	33,0	31,3	34,7	34,7	33	31,7	31,0	23,3	13,0	10,7	8,3	6,3

The distribution uniformity on the central band 5-15 meters (medium value)	
Medium number of granules on	30,48
Standard drift	4,45
Coefficient of variation %	14,61

- omitted values in calculus



Figure 3. The distribution uniformity establishing of the granulated crop protection products.

Photo: Pape

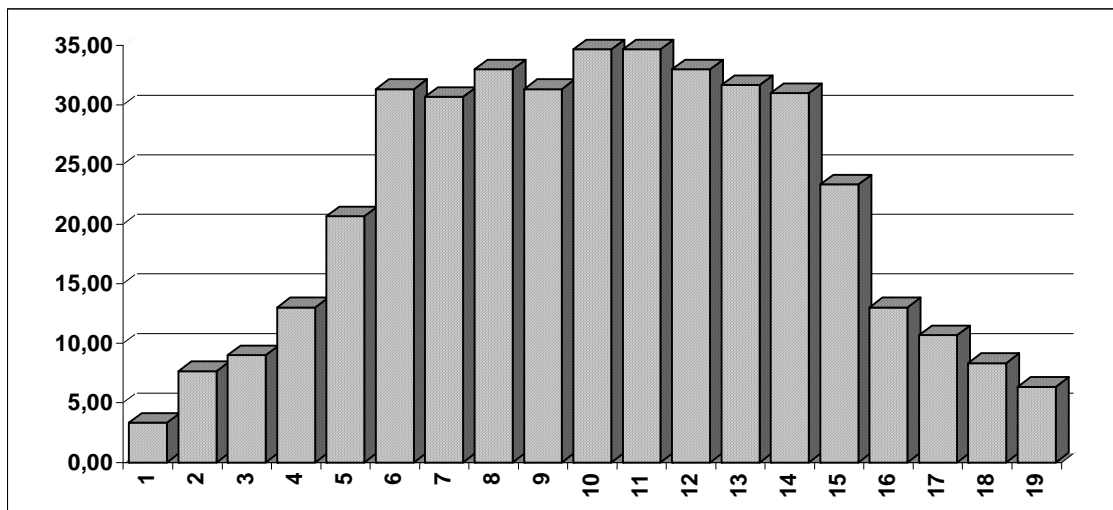


Figure 4. The distribution uniformity graphic of the granulated crops protection products (the medium value of those three repetitions).

From the graphic in figure 4 it becomes conspicuous the pesticide granules distribution uniformity on the middle of the treatment band on a width of 9 meters, the number of granules on square meter being included between 31 and 35. For the width of 11 meters the medium number of granules on square meter is of 30, 48.

We mention that, at present, there aren't any European or international standards of testing for the transversal distribution uniformity at the equipments for the granulated crop

protection products administration. The only guidelines for the testing are those from Germany, drafted by the Federal Biological Research Centre for Agriculture and Forestry (BBA) [3] and these refer to the terrestrial equipments.

Table 2

The distribution drifts and coefficient of variation calculus

The distance between two passages: 9 meters

The collector panel(m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Sample number																											
I Passage	5	7	8	9	21	33	32	34	23	35	33	26	28	25	28	9	17	11	8									19																											
II Passage										3	9	14	13	21	32	35	34	36	37	41	41	37	37	17	6	4	5	18																											
III Passage	32	30	32	30	31	25	24	11	9	7									2	7	5	17	20	29	25	31	35	19																											
The sum of those three passages	37	37	40	39	52	58	56	45	32	45	42	40	41	46	60	44	51	47	47	48	46	54	57	46	31	35	40	27																											
The drift given the medium																												27																											
The relative drift %	-17,85	-8,04	-17,85	-8,04	-11,18	-5,04	-13,40	-6,04	15,46	8,96	28,78	12,96	24,34	10,96	-0,08	-0,04	-28,95	-13,04	-0,08	-0,04	-6,74	-3,04	-11,18	-5,04	-8,96	-4,04	2,14	0,96	33,22	14,96	-2,30	-1,04	13,24	5,96	4,36	1,96	4,36	1,96	6,56	2,96	2,14	0,96	19,90	8,96	26,56	11,96	2,14	0,96	31,17	-14,04	-22,29	-10,04	-11,18	-5,04	27
The drift bigger than $\pm 30\%$															X														2																										
Medium number of granules on square meter.																										46,037																													
Samples number with drifts $\pm > 30\%$																										2																													
The standard drift																										7,783																													
The coefficient of variation CV [%]																										17,28																													

In accordance with BBA's assignments, which refer to the distribution uniformity on the working alignment (longitudinal), the blending drifts, for 25 samples taken at the distance of 20 centimetres on a routing, 20% of the samples (respectively 5 samples) can exceed with more of +/-30% the medium value of those 25 samples [3].

Using the boundary criterion of +/-30% for transversal distribution we establish that from those 27 values (samples) resulted at the simulation of those three passages for a working width of 9 meters, only two deviate with more than 30% (number 14 – 33,22 and number 25 – 31,17) given the calculus values average.

CONCLUSION

The gyrocopter utilisation for the application of granulated crop protection products presents a practicable alternative in the case in which their application is not possible by means of the terrestrial equipment.

With a length of the take off runway of 10-70 meters and of about 15 meters for landing, the gyrocopter yields to control measures application with aerial equipment particularly in the zones wanting of the facility necessary surfaces of a flight field for utilitarian aircrafts.

In comparison with the helicopters utilisation, the gyrocopters presents the advantage of a low cost price due in the first place to the low cost of acquisition of the gyrocopter, about 10% of a helicopter price.

We consider that in the future, at the same time with the equipping of this apparatus with electrically driven rotary atomiser (Micronair, Beecomist and so on) it could also be utilised for the application of sprayings with small volume of liquid, contributing in substantial manner to the cost price reduction of the pest control with aerial equipment.

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