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ANALYSIS OF THE VOLUME OF AGRICULTURAL AND AVIATION WORKS IN UKRAINE**R. Mnatskanov, D. Sc.; S. Pron, V. Lahutochkin,**

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The article provides analysis of the total volume of agricultural and aviation works in Ukraine over the period 2011–2013. The statistical data on the dynamics of agricultural and aviation works performed, such as: pest and weed control, control of plant diseases, fertilizer dressing, defoliation and crop desiccation. The trend in seasonality of agricultural and aviation works is defined.

Keywords: agricultural and aviation works, aviation works in agriculture, aviation chemical works.

У статті проаналізовано загальний обсяг виконання агроавіаційних робіт в Україні за період 2011–2013 рр. Наведено статистичні дані щодо динаміки обсягів виконання агроавіаційних робіт, а саме: боротьба з шкідниками та хворобами сільськогосподарських культур, боротьба з бур'янистою рослинністю, внесення мінеральних добрив, дефоліація та десикація сільськогосподарських культур. Визначено загальну тенденцію сезонності агроавіаційних робіт.

Ключові слова: агроавіаційні роботи, авіаційні роботи в сільському господарстві, авіаційно-хімічні роботи.

Problem statement

The agricultural sector of Ukraine is significantly changing with implementation of innovative technologies in growing crops.

The same tendency is characteristic of plant growing, and as a result, the correlation of the volumes of different works, in particular the agricultural and aviation works, shifts greatly.

The given article presents analysis and defines the current volume of different types of agricultural and aviation works and suggests the overall seasonality trend for all types of agricultural and aviation works.

Analysis of recent research and publications

As the analysis of scientific publications on total volume of performed agricultural and aviation works showed, the papers identifying the overall seasonality trend for all types of agricultural and aviation works are scarce.

Leading researchers and practitioners employed in the given problem are G. Mykhailov, G. Yun, V. Lahutochkin, V. Zahorulko, I. Herasymenko.

Unsolved part of the problem stated

The unsolved part of the stated problem refers to identification of the overall seasonality trend for agricultural and aviation works with the account of the condition of the agricultural production over the period 2011–2013.

Determination of the potential volumes of the agricultural and aviation works performed in Ukraine. Analysis of the volume in terms of: type, year and mode.

Objective of the article and main material

Performance of agricultural and aviation works enables timely and even application of agrichemicals, plant protection products, desiccants and defoliates decreasing the pesticide pressure on plants and soil, rearing beneficial entomophages to protect plants and prevents disturbance of crops during utilization of ground equipment.

In result, the access in crop grown only for grain equals to 30 %, whereas for other crops the access equals to 25 % of their average crop yield which supports operating profits from agricultural aviation and provides funds for the state budget [2].

In the period of reforms in the agriculture industry of the national economics the demand for agricultural and aviation works in 1999–2010 increased, quite the opposite tendency was demonstrated over the period 2011–2012 when a decrease in agricultural and aviation works performance took place. In particular, in 1999 the total area of application of agricultural and aviation works reached 228,0 thousand ha, in 2000 — 298 thousand ha, in 2001 — 771 thousand ha, in 2002 — 910 thousand ha, in 2003 — 620 thousand ha, in 2004 — 974 thousand ha, in 2005 — 745 thousand ha, in 2006 — 945 thousand ha, in 2007 — 1,1 mln ha, in 2008 — 1,3 mln ha, in 2009 — 779 thousand ha, in 2010 — 780 thousand ha, in 2011 — 712,2 thousand ha, the flight hours equaled 18,4 thousand hours, in 2012 — 561,8 thousand ha and 19,2 thousand hours respectively, 1st half of 2013 — 667 thousand ha of crop field was sprayed, the flight hours totaled 5,8 thousand (1st half of 2012 — 230 thousand ha and 8,5 thousand hours respectively) (Fig. 1).

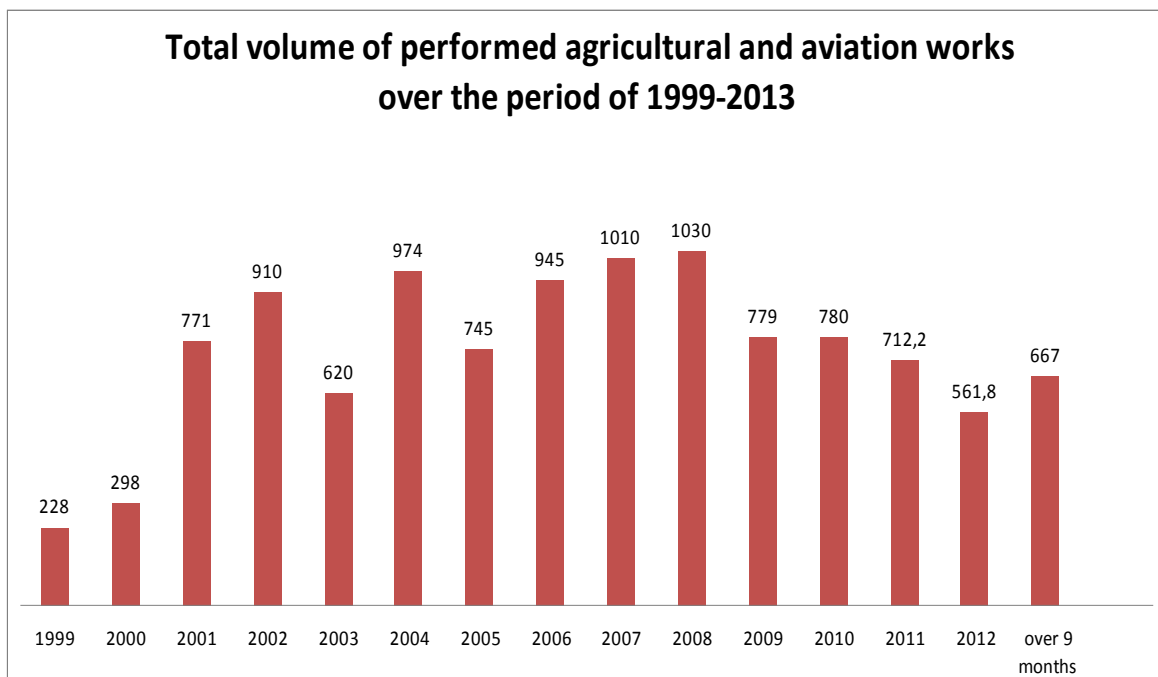


Fig. 1. Total volume of performed agricultural and aviation works over the period of 1999–2013

Today agricultural and aviation works are performed by light aviation (An-2, Mi-2) and ultra-light aviation, specifically by aircraft X-32 («Bekas») and «NARP-1». To date in Ukraine there are 165 units of An-2, Mi-2 — 26 units, NARP-1 — 9 units, and X-32 («Bekas») — 40 units.

Of them agricultural and aviation works are performed by: An-2 — 130 units, Mi-2 — 13 units,

NARP-1 — 6 units, and X-32 («Bekas») — 40 units (Fig. 2).

The range of works performed by Mi-2 encompasses spraying and dissemination, NARP-1 and X-32 («Bekas») perform only ultralow spraying and An-2 exclusively complies with the requirements for all types of agricultural and aviation works.

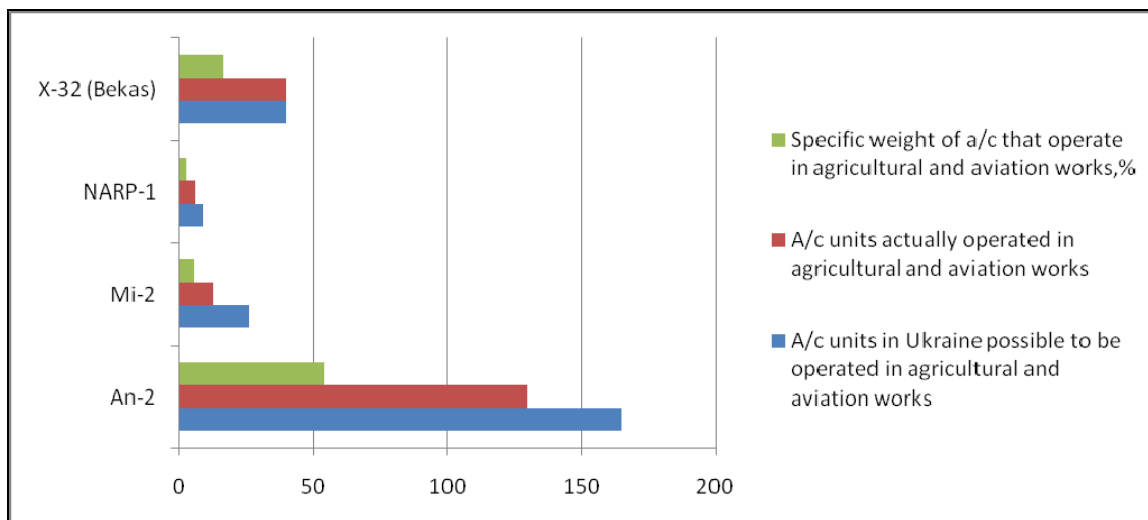


Fig. 2. Structure of aircraft fleet in Ukraine in 2013

The share of agricultural and aviation works in crop spraying in Ukraine in 2010 was respectively: fertilizer dressing — 41,79 %; pest control and control of plant diseases — 33,84 %; weed control — 11,92 %; desiccation and defoliation — 12,43 % [2].

Currently in Ukraine “No-till” farming is gaining extended application. The “No-till” system can be referred to as self-renewable. “No-till” is defined in

English exactly as “no-tillage”. “No-till” technology excludes tillage and all other kinds of mechanical disruption of soil to create a seedbed.

Seeding is carried out over the crop residues into uncultivated land.

Thus, to comply with the requirements, protective measures are to be taken using aircraft. No-till is the most reasonable approach to farming

justified from the point of view of ecology and economics [1].

In this case, any mechanical disturbance of soil is eliminated, which means that at the stage of preventive measures for plant protection aviation should be applied. Agricultural and aviation works are used to control plant diseases, in weed and pest control, desiccation of sunflower, fertilization of crops with liquid complex and bulk fertilizers during the vegetation period, foliage application, dissemination of trichogramma by air. Long-term practice of agricultural aviation application proved that aviation mode meets the same level of biological and economic productivity as the land mode and even exceeds it [3].

Having analyzed 2011 and 2012 (tables 1 and 2) we can assert that in 2012 the amount of agricultural

and aviation works performed was by 151 thousand ha lower than in 2011.

However, the flight hours increased from 18,4 thousand ha in 2011 to 19,2 thousand ha in 2012 (Fig. 3).

Comparing the productivity of 2011 — 38,70 ha/flight h and of 2012 — 29,29 ha/flight h, we can state that the volume of agricultural and aviation works aimed at fertilizing soil grew and the expenditure rates increased per ha.

The segment of agricultural and aviation works remained unaltered when compared to the previous years. Majority of agricultural and aviation works is performed short-term. Such works like pest control and control of plant diseases are carried out mainly from April to July and, in part, in March and August-November (Fig. 4) [4].

Table 1

Performance of agricultural and aviation works in 2011

Month	Area of application		Pest control and control of plant diseases		Weed control		Fertilizer dressing		Defoliation and desiccation	
	thousand ha	% total	thousand ha	% total	thousand ha	% total	thousand ha	% total	thousand ha	% total
January	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
February	36000	5,05	0	0,00	0	0,00	36000	10,64	0	0,00
March	149000	20,92	4000	1,91	50000	57,14	95000	28,07	0	0,00
April	73000	10,25	13000	6,20	20000	22,86	40000	11,82	0	0,00
May	60000	8,42	22000	10,49	3000	3,43	35000	10,34	0	0,00
June	158000	22,18	78000	37,18	0	0,00	65000	19,21	15000	19,61
July	126000	17,69	76600	36,51	0	0,00	35400	10,46	14000	18,30
August	25000	3,51	4500	2,14	5500	6,29	6500	1,92	8500	11,11
September	65000	9,13	2500	1,19	9000	10,29	14500	4,28	39000	50,98
October	15000	2,11	7000	3,34	0	0,00	8000	2,36	0	0,00
November	5200	0,73	2200	1,05	0	0,00	3000	0,89	0	0,00
December	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
Annually	712200	100	209800	100	87500	100	338400	100	76500	100

Table 2

Performance of agricultural and aviation works on monthly basis 2012

Month	Area of application		Pest control and control of plant diseases		Weed control		Fertilizer dressing		Defoliation and desiccation	
	thousand ha	% total	thousand ha	% total	thousand ha	% total	thousand ha	% total	thousand ha	% total
January	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
February	18000	3,20	0	0,00	0	0,00	18000	8,92	0	0,00
March	66000	11,75	4000	1,90	32000	51,61	30000	14,87	0	0,00
April	49500	8,81	9500	4,50	15000	24,19	25000	12,39	0	0,00
May	33000	5,87	10000	4,74	3000	4,84	20000	9,91	0	0,00
June	140000	24,92	90000	42,67	0	0,00	34000	16,85	16000	18,37
July	143800	25,60	82000	38,88	0	0,00	41800	20,71	20000	22,96
August	31600	5,62	4600	2,18	5000	8,06	12000	3,47	15000	17,22
September	61100	10,88	3000	1,42	7000	11,29	20000	7,43	26100	41,45
October	13100	2,33	5100	2,42	0	0,00	8000	3,96	0	0,00
November	5700	1,01	2700	1,28	0	0,00	3000	1,49	0	0,00
December	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
Annually	561800	100	210900	100	62000	100	211800	100	77100	100

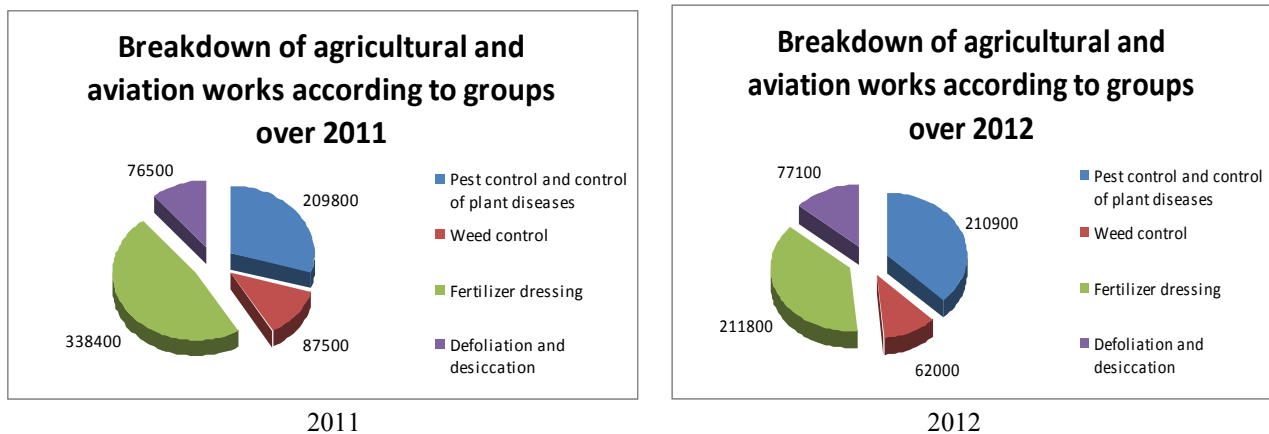


Fig. 3. Breakdown of agricultural and aviation works according to the area serviced 2011–2012

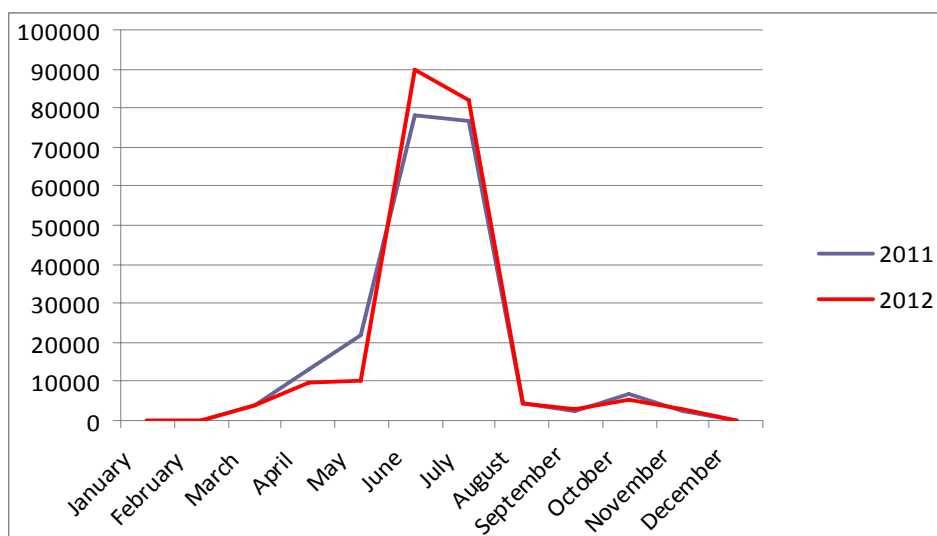


Fig. 4. Area serviced for pest control and control of plant diseases over 2011–2012

Analysis of statistical data demonstrated the following:

January and February — the works were not performed;

March — pest control and control of plant is performed mainly in the Crimea to fight ground beetle and a variety of fungus diseases;

April — mainly in Poltava, Kyiv, Cherkassy and Kharkiv oblasts;

May — mainly to perform pest control of white beet, owl moth (trichogramma dissemination, I round), snout beetle, flea beetle, and a variety of fungus diseases (powdery mildew, blackspot, Septoria disease, etc.);

June — agricultural and aviation works were performed in southern regions to fight corn bug, Anisoplia austriaca beetle, charcoal rot, cereal leaf beetle, bur bud weevil, and a variety of fungus diseases (blackspot, Septoria disease, etc.);

July — agricultural and aviation works were performed in all regions, II round of trichogramma dissemination;

August — agricultural and aviation works were performed mainly against white beet cercosporosis, round of trichogramma dissemination;

September — agricultural and aviation works were carried out in the 1st decade against white beet cercosporosis;

October — mainly the Crimea, to fight ground beetle;

November — mainly the Crimea, Kherson and Odessa oblast to fight ground beetle;

December — the works were not performed.

Weed control in Ukraine is carried out in spring months and after harvesting in the last decade of August and almost the entire September. The agricultural and aviation works of spraying herbicides over residues were performed (Fig. 5) [4].

Having analyzed the statistical data we obtain the following:

January — the works were not performed;

February — the works were not performed;

March — the Crimea, Kherson, Zaporizhia, Mykolaiv and Odessa oblasts;

April — central and southern regions;
May — southern regions;
June — the works were not performed;
July — the works were not performed;
August — central and northern regions (spraying herbicides over residues);
September — central, southern and northern regions (spraying herbicides over residues);
October — the works were not performed;

November — the works were not performed;
December — the works were not performed.
 A large amount of agricultural and aviation works with the purpose of fertilizer dressing is performed from March to July. In the case early spring and side seepage of various crops is carried out. Beginning with August and until November the autumn seepage with potassium fertilizer is done (Fig. 6) [4].

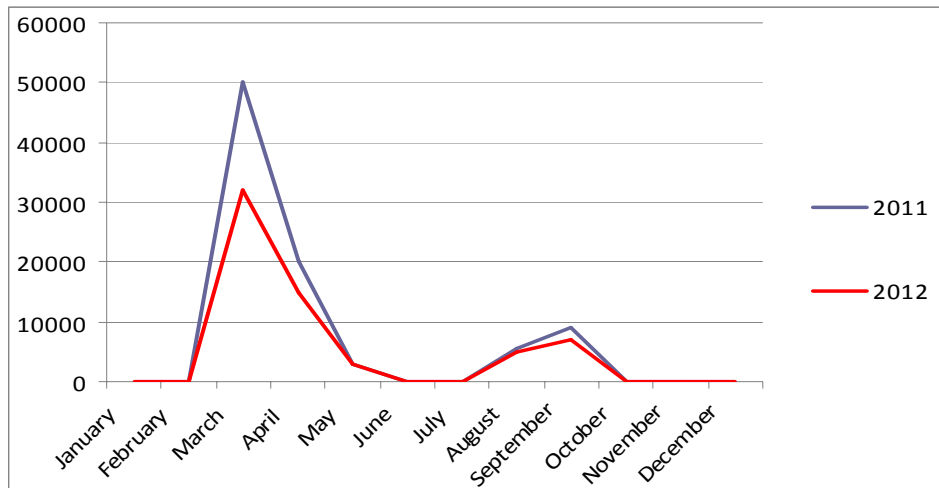


Fig. 5. Area serviced for weed control over crop fields 2011–2012

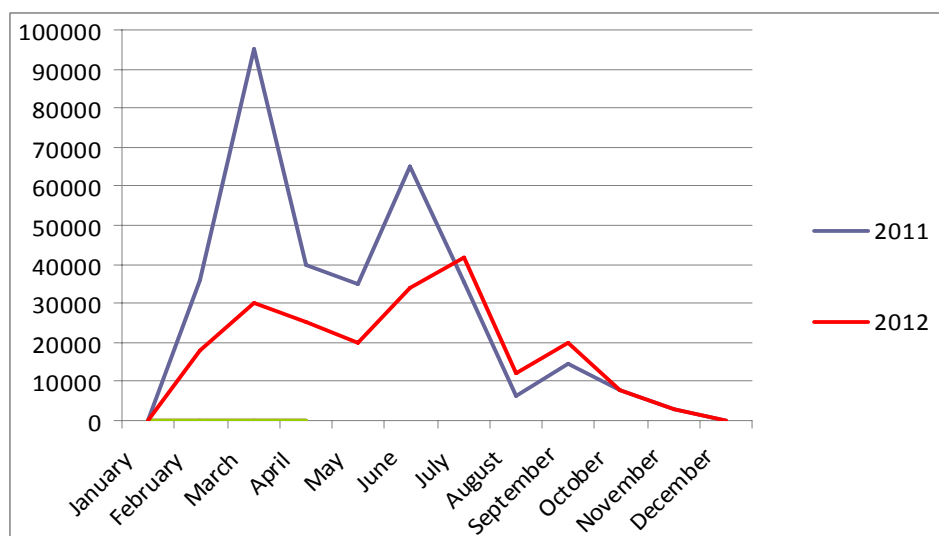


Fig. 6. Total area service by agricultural and aviation works for fertilizer dressing over 2011–2012

Analysis of statistical data showed the following:
January — the works were not performed;
February — the Crimea, Kherson, Mykolaiv and Odessa oblasts;
March — the Crimea, Kherson, Zaporizhia, Mykolaiv and Odessa oblasts;
April — central and southern regions;
May — southern regions (side seepage);
June — central and east-southern regions (side seepage);
July — central and eastern regions (side seepage);

August — central, southern and eastern regions (before tilling);
September — central and northern regions (for tilling);
October — the Crimea, Kherson, Zaporizhia, Mykolaiv and Odessa oblasts (autumn dressing with potassium fertilizer);
November — the Crimea, Kherson, Zaporizhia, Mykolaiv and Odessa oblasts (autumn dressing with potassium fertilizer);
December — the works were not performed.

Desiccation and defoliation are performed June to September. In 2011–2012, these works were carried out in Ukraine over approximately the same area 76,5 and 77,1 thousand ha respectively, mainly over sunflower and rapeseed fields.

In *June* and *July*, the agricultural and aviation works are performed generally over rapeseed fields in most regions of Ukraine with the exception of western oblasts. In August, agricultural and aviation works aimed at desiccation and defoliation are performed, in particular, in the southern regions (desiccation of sunflower); and in September - in central and eastern regions (desiccation of sunflower) (Fig. 7) [4]. How seasonal agricultural

and aviation works are can be assumed from the following data in tables 1 and 2 below. In 2011, 20,92 % of the total volume of agricultural and aviation works were performed during March, and almost 39,87 % of the total volume — in June and July (Fig. 8) [4].

Analysis of the total volume of agricultural and aviation works in 2012 revealed that in March 11,47 % of works were carried out (agricultural and aviation works aimed at fertilizer dressing and weed control) and around 50 % were performed in June and July (agricultural and aviation works aimed at fertilizer dressing, pest control and control of plant diseases, desiccation and defoliation) Fig. 9).

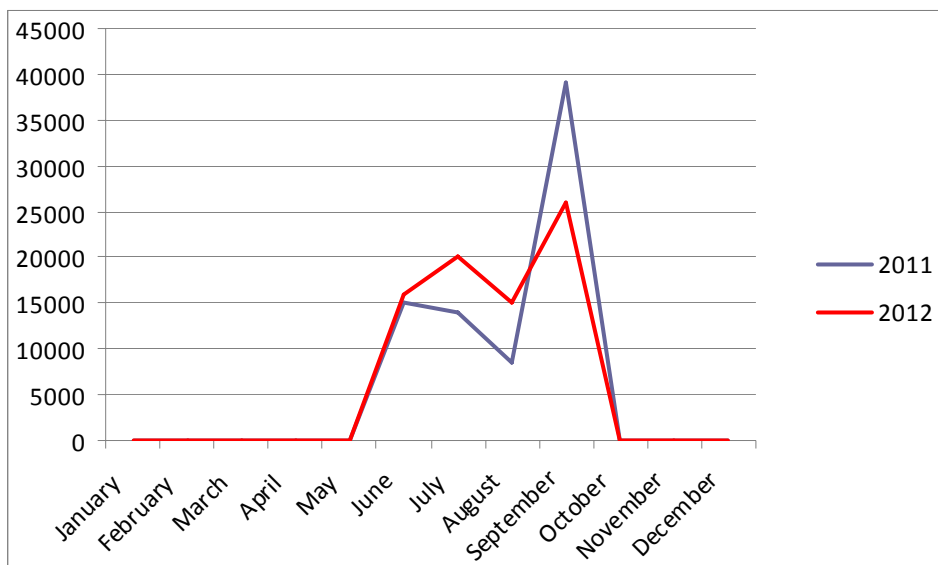


Fig. 7. Area serviced at plant desiccation and defoliation over 2011–2012

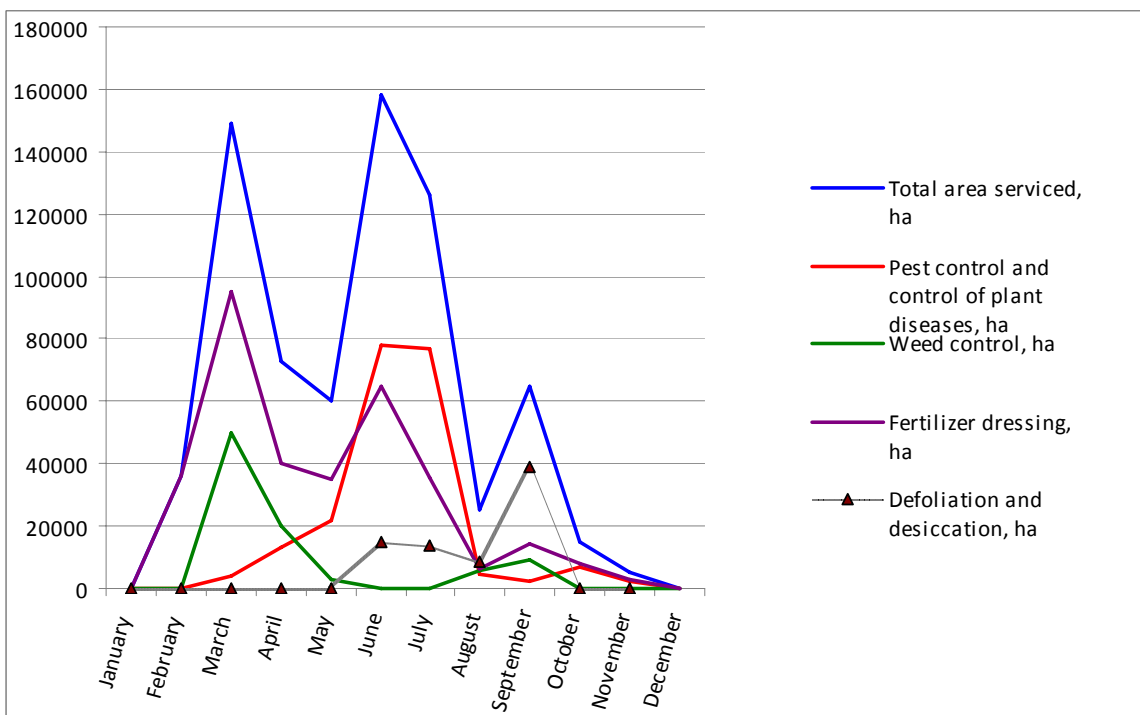


Fig. 8. Seasonality of performed agricultural and aviation works over 2011

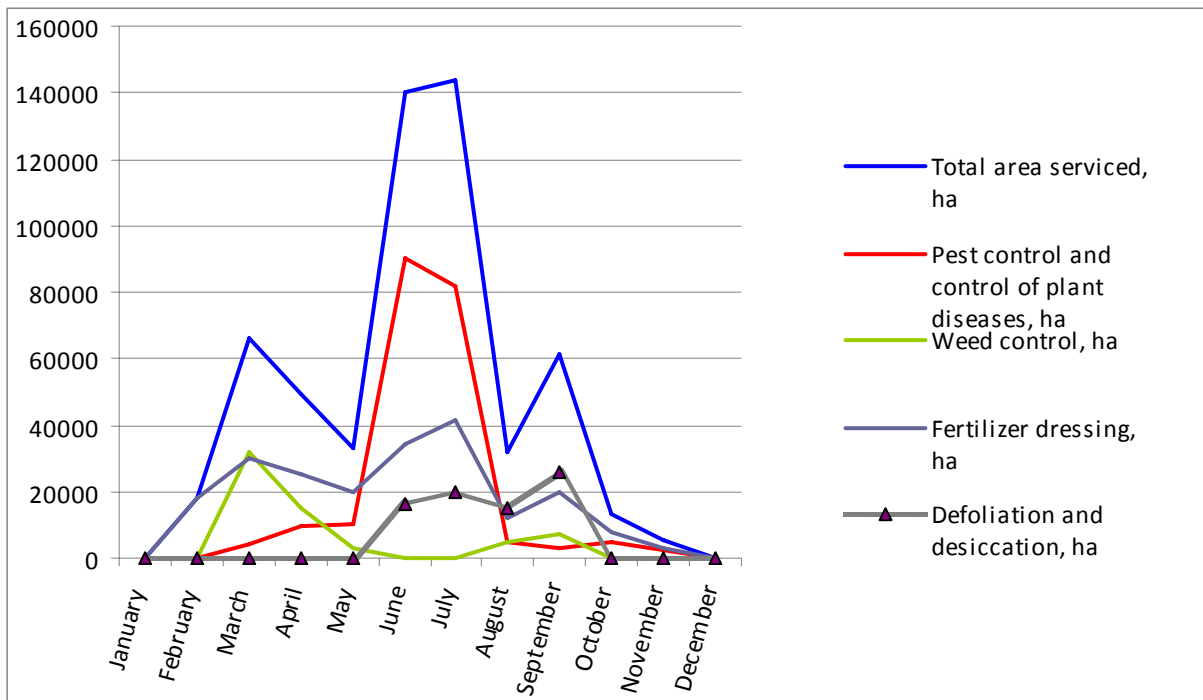


Fig. 9. Seasonality of performed agricultural and aviation works over 2012

In Ukraine, a fixed trend has emerged to apply the No-till technology with a main principle of minimizing the mechanical influence on soil, and exactly agricultural and aviation works take over the major share in this activity. According to the type and purpose of the works and application of chemicals, agricultural and aviation works are categorized into four groups: pest control and control of crops diseases; weed control; fertilizer dressing; and defoliation of crops. Such classification of agricultural and aviation works corresponds to their field of application and simplifies their planning, analysis, etc.

Conclusion and prospects for further research

Considering the area and specific weight, the leading group of agricultural and aviation works is fertilizer dressing which in 2012 equaled 338400 ha and accounted for 47,5 % of the total volume of works, in 2012, 211800 ha was serviced which accounted for 37,7 %. According to labor input, which in a way is illustrated by flight hours, this group of agricultural and aviation works accounts for more than a half of the total agricultural and aviation works. Having compared the productivity values of 2011 (totaling 38,70 ha/flight h) and of 2012 (29,29 ha/flight h) we can assert that the volume of agricultural and aviation works aimed at fertilizing soil grew and the expenditure rates increased per ha.

Control of plant diseases and pest control in 2011 reached 209800 ha and accounted for 29,45 %, whereas in 2012 it totaled 210900 ha and 37,54 % of total volume of agricultural and aviation works. Such agricultural and aviation works as weed control, desiccation and defoliation in 2011 were

performed over 87500 ha and 76500 ha, which accounted for 12,28 % and 10,74 %, and in 2012 — 62000 ha and 77100 ha and 11 % and 13,75 % respectively. Today, collection of objective data is quite difficult. The carried out research showed that objective data is overall scarce.

It is required to create the mechanisms of influencing the housing entities that would encourage rendering completely objective information. This will promote scientific approach to development of modern technology of agricultural and aviation works.

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