THE ROLE AND POSSIBILITIES OF THE AGRICULTURAL AVIATION IN HELPING DEVELOPING COUNTRIES

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ABSTRACT

A problem of the World population and a food deficiency in the World is briefly presented. On this background the role and possibilities of agricultural aviation especially for developing countries is analised. In conclusion, is suggested to estabilish of World Aviation Help Service (WAHS) under UN auspices.
Key word: Agricultural aviation, developing countries, aviation.

WORLD POPULATION AND AGRICULTURE

Studies and analyses of the Food and Agriculture Organization (FAO) emphasize the immense problem of food deficiency in the World. The World's population was estimated to be 5084.8 million in 1988, and will grow in first part of the next century to 6.3 billions in 2000 year and 7.2 billions in 2010. The rate of the growing is different. For developing countries: from about 2 % (average 1990-1995) to 1.4 % (av. 2010-2015) compare with 0.45 % and 0.23 % respectively for developed world.

It is predicted that the area of in agricultural use land will be increase to about 27.7 million ha per year, to receive the level of 5.12 million ha in 2000. That will results in the further reduction of agricultural use land rate per person from 1.015 ha/person in 1980 to 0.8 ha/person in 2000. That is about 20 % of reduction.

In the second part of XX century- pesticides are the revolucion in agriculture, growing the production of crops in twice, and grow up they quality. Global estimates of same crop production in the decade 1965 and 1987 are: Wheat 266 Gkg to 517 Gkg; Maize: 219 Gkg to 457 Gkg; Vegetables 202 Gkg to 421 Gkg.

The production, distribution and consumption of food products are unequal in the World and in some countries particulary in Africa situation is critical. The decreasing of food production with the population incerase effects in negative growth of agriculture products per head of population. For example in decade 1977-1988: Papua New Guinea 0.0 %, Fiji - 0.5 %, Botswana - 4.8 %.

The average yearly increase of agricultural production in decade 1980 - 1990 in percentage is presented in table 1.

Table 1. Average yearly increase of agricultural production (1980 - 1990)

Region	crops	cotton	meat
	%		
World	1.75	2.42	2.85
Western Europe	1.24	7.73	1.26
CIS & Eastern Europe	2.09	0.55	2.44
USA	-0.46	2.22	1.68
Oceania & Australia	1.63	14.72	1.03
Africa	3.86	7.17	2.19
South America	0.85	0.98	2.21
Far East	2.89	4.05	6.92

The main problems in Third World countries are: the land is often dry and stony, deficient in both water and nutrient mineral salts. There are often only hand - held tools for tilling the soil, and insufficient water for irrigation. Moreover there is nothing to control insect pest on crops, or to prevent stored foods from pests.

The result is shortened lifespans, higher infant mortality, greater risk of disease; 15 million people die each year from starvation or the diseases linked to it, one in two people in the World do not get enough to eat.

The World Health Organization (WHO) says that minimum aduld intake should be: energy 10920 kJ, protein 65 g.

In table 2 intake protein and energy per person in some countries is presented.

Table 2. Protein and energy intake per person (1990 year)

Country	Intake	
	protein (g)	energy (kJ)
USA	106.5	15300
UK	88.0	13680
Japan	88.0	12000
Niger	66.2	9860
India	53.9	9260
Nigeria	46.6	8880
Ghana	38.2	7280
Mozambique	28.4	6750

In opinion of FAO specialists the increase of food production is to be based on:
1. regulation of water conditions
2. using of more fructiferous varietes
3. proper cultivation
4. control of diseases and pests
5. fertilizing

but in future no significant role will play the increasing of cropland.

In the food production important problem play also high crop losses caused by diseases and culture pests.

In 1987 % loss in some crop production were: wheat 9.1 %; maize 9.4 %; potatoes 21.8 %; vegetables 10.1 %; citrus fruits 16.4 %.

AGRICULTURAL AVIATION

It is most popular name for more general notion of "Bio-aeronautics", understood as "application of different types of aviation to the development of useful living organisms on the Earth". This field of aviation is 85 years old. As the origin of it, is considered the patent received by Alfred Zimmemann, a forester from Germany on 1911.03.21.

A rapid development of bio- aeronautics took place from 1950. The increase in numbers of airplanes, treated area and average efficiency are presented in table 3.

Table 3. Developing of agricultural aviation

year		1950	1960	1970	1980	1990
Treated area $\cdot 10^6$ [ha]	Total	26.5	61.5	153.85	270.0	370.0
	USA	13.2	24.6	40.0	72.8	121.7
	SU	6.7	20.1	80.3	101.4	108.0
Number of airplanes	Total	5760	10923	16932	26100	35000
	USA	4500	5077	6000	8650	13680
	SU	-	-	7538	10000	12000
Average efficiency	ha/aircraft	4600	5600	9086	10344	10572

At present the bio-aeronautics is used at least in 6 branches of national economy: agriculture, forestry, water mangement, environmental protection, health, energetics. Over 120 different types of treatment are used.

The main advantages of agricultural aviation are:

- quick-acting. To give possibility to receive quickly, territory where some anomalies took place (earthquake, flood, landslip) and come in to somebody help. From the other hand the quick- acting effects in high efficiency. For example: a treatment 1500 ha per day in forest pest control.

- airplanes and helicopters do not compact the most fertile soil layer and can be used when it is not possible to employ ground machinery (waterlogged soil)
- aircrafts do not transport on the element of constructions pests, deases, weeds from one part of the field to other.
- aircrafts can be active in regions with poor infrastructure and, for this reason, are especially useful in a widespread areas of Africa, South America, Asia and others (Akesson & Yates 1974).

  The disadvantages are related to: high costs-costs of airplanes, maintenance and spare parts, their operation, costs of pilot education and training, the cost of insurance, ect.
- high hazard of invironmental polution, conected with highter than ground sprayers level of spraying and flow disturbances around flying aircraft.

THE POSSIBILITIES OF THE AGRICULTURAL AVIATION

In spite of its small actual operating range on the World scale, the agricultural aviation can play very important role to the improvement of the nuritional World situation especially for countries in the continents of Asia, Africa, South and Central America. In those regions a feable infrastructure, a very poor agricultural mechanization and a shortage of specialists cause that in some fields of activities the only practical alternative is the agricultural aviation.

The main fields of activity of agricultural aviation are:

1. control of human and animal disease vectors (tsetse fly, onchocerciasis)
2. control of mass infestations (Locust, Quilea)
3. plant protection treatment (cereals, cotton, rice, maize, root crops and others)
4. application of fertilizers
5. reclaiming, erosion control, ground stabilisation
6. delivery of agricultural products
7. health control

The great role is to be played by the agricultural aviation in fighting with tsetse fly. The problem concerns Mosambique and the fertile regions of Central Africa where large-scale animal production can be developmened after extermination of the insect. Simultaneously, the danger of Africa coma (sleeping sickness), involving 35 mil. of people could be limited.

An extremaly essential problem is the aerial control of larve of Simulium damnosum, the vector (carrier) of Onchocerciasis (River blindness) (Sepp Bauer 1975). It cover 7 mil. ha the part of West Africa. In the countries: Ivory Coast, Hali, Upper Volta, Ghana, Togo, Dahomey, Nigeria and Cameroun-River blindness is common. The inhabitants of whole villages have abandoned the fertile soils bordering the rivers for fear of this terrible pest. In a few areas more than 80 % of the population is infected.

It is estimated by World Health Organisation that about 1 mil. of people suffers from that disease escape from the most andengerad regions and about 1 mil. of arable land have been deserted by people.

The black fly lays between 250 and 500 eggs on support in the rivers such as plants or stones. These eggs can be found submerged as deep as 0.50 m belong the water level and at location where the water is turbulent and rich in oxygen. It is proved to be possible to will the larvae of Simulium by applying insecticide to the water. At the request of WHO in Geneva, Air Lloyd carred out a helicopter succesful operation to control the larvae in 1972 and the second operation 1973. In 1979 the program of fighting larvae carriers of that disease was developed by the World Health Organization.

The Polish Aircraft Industry constructed an up-to-date apparatus to control the Simulium damnosium, instaled on a Mi- 2 helicopter and An- 2R airplane.

The Locust, one of the "Egipcian plaque" still couse extreme damages in plants in regions of Africa and Asia. In 1978 60 states were endangered by that plaque. The problem was broadly analysed, at least by 30 years, by several autors, particulary by R. S. Rainey. (Rainey, Joyce 1990).

Now it is possible to say that the tree elements which play the most important role for aerially Desert Locust control are ready. The first is an airborne Doppler radar navigation system, with precision wind-finding facility. The second element is the Cranfield airborne insekta dedecting radar (ABR) for quantitative assessment. And a new technology of treatment "air to air spraying methods".

Experiments with ABR and air to air application technique gave the best results as a aerially locust control system.

In Sudan the agricultural aviation is applying in success to control of wanderer Quilea- birds. A big phylum of birds can totally demage large area of crops.

For many regions of the World with bad infrastructure, and poor agricultural mechanization, as a standard activites of agricultural aviation can be plant protection treatment. Aerially applied pesticides to give a good coverage of chemicals and right biological effect, to assure many times higher productivity than any ground sprayer. Agricultural aviation can help in crop fire control which is danger for big monucultural cropland.

It is a lack of information about actual aerial spraying of pesticides in the World. In table 4 average yearly weights of pesticides applied by the agricultural aviation in decade 1975 - 1980 is presented.

Table 4. Average yearly weights of chemical agents as applied by the agricultural aviation (years 1975 - 1980)

Continent	Weight (mln kg)	
	Fertilizers	Pesticides
Europe	11.400	3.250
Asia	900	200
Africa	500	100
North America	4.600	1.100
South and Centr. America	2.800	800
Australia & Oceania	1.000	250
Total	21.200	5.700

Intensification of crop production can be done by increase of fertilization. The average yearly utilization of three main fertilizers in the years 1976 - 1977 and planned for 2000 has been presented in table 5.

That will cause the average rate of chemicals to increase from 25 kg/ha of cropland to 66 kg/ha in 2000, on the World scale. Thus, the increase of crop production about 45 % can be expected. The agricultural aviation can play important role in distribution of chemicals for developing countrees and treatments. As an example in table 4 is presented average yearly weights of fertilizers applied by agricultural aviation in decade 1975 - 1980.

Table 5. Average yearly utilization of fertilizers in the year 76/77 and as planned for 2000 (in mln kg)

Continent	1976/77			2000		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Europe (without USSR)	12.4	8.2	8.2	28.3	23.1	23.9
Asia	11.1	4.6	1.9	50.0	20.9	10.0
North America	10.4	4.8	6.1	27.8	10.9	12.6
Centr. and South America	2.6	1.7	1.3	9.1	8.3	5.7
Africa	1.3	0.9	1.3	5.2	3.1	1.3
Oceania & Australia	1.3	0.9	0.9	1.3	1.7	1.3
USSR	7.1	3.9	5.4	34.6	10.0	13.0
Total	46.2	25.0	25.1	166.3	78.0	67.8

For many continents, the forest complexes play an essential role in their nutritional problems. The total area of forests on the terrestrail globe is 4.130 mil. ha, that is 31.7 % of the World surface. They are a direct source of nutrition for many countries, or even regions.

In many countries, the agricultural aviation is strongly engaged in the forest protection. That involves systematic patroling actions and a forest fire control, as well as fighting of pests which occur in extermely high gradations in certain periods of time. In Canada, in 1976, the area of 8.524 thousand ha vere involved in the control of Choristoneura fumiferana in the top period of its gradation, 935 aircrafts taking part in that action.

In Poland, high gradations of Lymantria monacha - L occured in since 1977. In the critical year 1982, 2.400 thousand ha was covered with the control. That is 27 % of the total forest area of Poland. 160 agricultural airplanes and 22 helicopters being engaged.

CONCLUSIONS

1. To estabilish the World Aviation Help Service (WAHS) under UN auspices and under direct FAO control working with cooperation with WHO, UNICEF and other international or national organizations and private enterprises.
2. To develop a logistic system for airplanes nad helicopters working for WAHS on all continents.
3. To avoid the typical for agriculture seasonality of work this system should assure the complexity of WASH activity in all directions including the system of fuel, chemicals and other necessary materials and products supply.
4. To introduce under FAO auspices schools, trainings centres for agricultural aviation workers from developing countires as it was previously in national agricultural aviation centers - in England - Cranfield, Silsoe and in Poland - Olsztyn.

REFERENCES

1. Akesson, N.B., W.E. Yates (1974). The use of Aircrafts in Agriculture FAO. Roma.
2. Bauer Sepp, (1975). Helicopter Operations in the Control of Simulium damnosum in West Africa. Agricultural Aviation No 2.
3. Development of Airborne Equipment to Intensify World Food Production. 1981 United Nations. Economic Commission for Europe. New York.
4. Food and Agricultural Organization - Twentieth Session Agriculture. Toward 2000. Rome 10-29 November (1979).
5. Rainey, F.R.S., R.J.V. Joyce (1990). An Airborne Radar System for Desert Locust Control. Phil. Trans. R. Soc. Lond. B 328, 585-606.