SUNFLOWER SEEDLINGS TRANSPLANTATION FOR DOUBLE CROPPING IN IRRIGATION

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INTRODUCTION

In the climatic conditions of Vojvodina (Yugoslavia), there is a long period between the harvest of small grains and the occurrence of frost in the fall. The period lasts for 80 - 100 days and since it covers summer months (July, August, September), with high air temperatures and intensive insolation, it is used for double cropping in irrigation systems. It means that two crops are obtained annually from the same plot.

Some vegetables (string beans, cabbage, cucumbers) are double cropped successfully. The double cropping of silage crops, corn, sorghum, etc., is quite safe. However, agricultural producers are interested in double cropping for grain. To realize this projection it is necessary to have not only early varieties and hybrids of wheat, barley, corn, sunflower, soybean, etc. but also other favorable conditions - sufficient water in soil and appropriate temperature sum. The former may be secured by irrigation while the latter depends on the climatic conditions of the region in question, becoming frequently a limiting factor of such a production.

DOUBLE CROPPING IN VOJVODINA

In Vojvodina, the wheat is harvested at the beginning of July. It means that a double crop may be planted by July 10 at best. Therefore, the sum of bioclimatic temperatures to first frosts, which occur in mid-October or frequently in late September, is approximately 1,800°C.

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The sum of bioclimatic temperatures necessary for the maturation of early varieties and hybrids of corn, sunflower, and soybean ranges between 2,050 and 2,400°C. It means that the temperature sum for Vojvodina is 300 - 500°C short of the sum necessary to produce grain in double cropping.

In spite of extraordinary achievements in the breeding for early varieties and hybrids of the above crops, the problem of maturation of double crops remains open. Double crops mature normally only if crop rotations include first crops which mature and are harvested in June. In that case, the yields of doubel crops are quite high - 50-53 q/ha of corn grain, 16 q/ha of sunflower seed. Presently, the only first crop which is harvested in June is the pea for canning. Unfortunately, it is grown on too small a hectarage to efficiently solve the problem of double cropping for grain. An answer should be found how to make use of the period after the harvest of small grains which take up to 30% of the total hectarage of the irrigation systems.

DOUBLE CROPPING OF TRANSPLANTS

Starting with the fact that transplantation saves time by reducing the temperature sum necessary in field, we tried to apply transplantation, a regular practice in vegetable growing, in the double cropping of certain field crops. As this practice is not mentioned in literature, it may attract interest in many countries which have the same interests in and encounter the same problems with double cropping as is the case with Vojvodina. It should be added here that transplantation is a regular practice on millions of hectares under rice and tobacco, but there are no data on the growing of other field crops with transplantation.

Vegetable production has a considerable experience and tradition in this respect. It is well-known that good transplants hould look like regarding their growth and development. It is also known that outgrown transplants are difficult to take, rendering poorer results. However, specific problems occur when growing transplants for double cropping because the basic intention is to save as much time as possible in order to prolong the maturation and obtain higher yields. However, an early planting in the mursery renders outgrown transplants. Coversely, a later planting renders excellent transplants but timesavings are so small that the success of double cropping is

brought into question. Our experiments showed that only those transplants which emerge by the end of June stand chances of fully maturing in fall. It means that in the conditions of Vojvodina the planting in nurseries should be performed in the third decade of June as to be able to perform the operation of transplanting by mid-July.

In the first experimental year (1978), the sunflower hybrid NS-H-26-RM rendered encouraging results (Table 1) when grown as a double crop with transplantation: the yield was excellent, the maturation normal, the moisture of seed satisfactory, and the taking of transplants above expectations (over 90%). The chemical composition of seed was normal, the oil content high (Table 2). The transplanting was performed manually.

TABLE 1

Sunflower transplants in double cropping (NS-H-26-RM)

Planting date	No. of plants/ ha.	Plant height, cm. at trans-planting	Plant height, cm. at harvest	Head diameter cm.	Seed moisture %	Seed yield q/ha.
I	40,700	60	118	13	16.7	15.44
II	51,200	40	127	12	20.3	16.21
III	52,400	20	119	15	24.7	24.19

TABLE 2

Analysis of seed of double cropped sunflower transplants

Planting date	Weight of 1000 seeds gr	Oil %-age in seed	Husk %-age	Kernel %-age
I	47.5	43.52	29.7	70.3
II	49.0	43.90	28.3	71.7
III	45.1	44.37	28.2	71.8

Encouraged by these results, we established an experiment in 1979 with mechanized transplantation in productional instead of experimental conditions. The experiment was performed at the irrigation field os Agroindustrial Combine "Becej". The planting in nursery was performed on June 30 and July 1, 1979, the transplanting on July 13. The taking of transplants was surprisingly successful - 100%. The crop matured and was harvested on October 29. The results given in Table 3 not only encourage but convince us that this is a sound method of obtaining two crops of grain annually in climatic conditions which otherwise do not allow it.

TABLE 3

Sunflower transplants double cropped in productional conditions (AIC "Becej", 1979)

Seed yield, q/ha. - 17.8	Plant height, cm. - 107	Head diameter, cm. - 16
Kernel %-age - 72.8	Husk %-age - 27.2	Oil content, %-47,9
1000 seeds Weight, gr	Germability, % - 97	

Wider aspects of double cropping of sunflower transplants.

Such a production of sunflower seed gains importance because it accomplishes something that has been impossible before. It opens up a prospective of an intensive use of land in irrigation systems, especially in the regions in which animal husbandry is not developed and, therefore, there is no need for a production of green forage in double cropping. When the technology of production is improved, it will bring considerable changes in the systems of cropping and crop rotation because experiments with other crops also brought promising results. Finally, the practice of irrigation itself gains additional importance.

Such a production is especially significant for sunflower breeding because it secures two crops annually, both obtained in natural conditions. The need for the construction and maintenance of expen-

sive greenhouses is reduced to a minimum. The obtained breeding materials are checked more efficiently in natural conditions.

In view of the existence of a number of sunflower diseases, this method of production may bring interesting changes because of changed conditions of growing.

There is an additional opportunity for sunflower seed production.

There are numerous prospectives for research in the fields of cultural practices, breeding, phytopathology, physiology of sunflower, etc. For examples, the root system of double cropped sunflower undergoes changes in form, degree of development, etc.

A path from an idea to its realization invariably leads through difficulties and trials. We are at the very beginning in the double cropping of sunflower transplants. Yet, the idea should be tried to be realized because only ideas and experimentation secure progress.

CONCLUSION

The experiments and the preliminary checks in practice indicate that sunflower seed may be obtained from double cropped sunflower transplants in climatic conditions in which double cropping for seed in combination with regular planting is impossible.

Further studies and improvements of production technology will produce a final solution which will bring multiple advantages - increases of the potentials for food production, upgrading of the efficiency of breeding, intensification of land use, possible changes in the occurence and intensity of diseases, etc.