

**Mixed crops systems and possibility of improving the on-farm use of irrigation water:
the case of potatoes crops**

Abstract

Potatoes are one of the seven crops considered as strategic for Tunisia. They grow on a surface area of 24 300 hectares divided into 25 000 parcels and 18 000 producers grow this crop. 78 % of these farmers have a total surface area of less than one hectare and 14 % have land under two hectares (CTPT, 2005). For seasonal crops (February to May), that represent 50% of the surface area devoted to potatoes, irrigation water is the main limiting factor for production because of high water demand for these crops (400 to 500 mm) and little rainfall that meets only 15 to 20% of needs. Thus, the sustainability of this activity, mainly for small enterprises, implies improvement in the economic productivity of their management system. This can only be achieved with more efficient management and sharing out of production costs, mainly irrigation water and fertilisers.

The adoption of mixed crop systems in the irrigated areas could constitute an "agronomic way" of increasing the value added per m³ of water used by reducing losses and bad use of irrigation water noticed for single crops on the one hand, and by integrated management of the demand and resources in fertilisers, on the other hand.

The purpose of the enterprise survey carried out in collaboration with the Potato Technical Centre was the improvement in the efficiency of water, light and nitrogen use for small potato plots. It proposed to test the possibility of introducing sulla, a fodder crop, in association with seasonal potato crops which use a lot of irrigation water. The choice of this secondary crop is based on the dual advantage that this crop offers. On the one hand, it is grown in rainy conditions and on the other hand, it can reduce the nitrogen necessary for potato growing, around 480 kg/ha, thanks to its ability to fix atmospheric nitrogen.

Experiments were carried out on a CTPT parcel. The study was to compare the parameters necessary for growth and yield for single crops and mixed crops in cases where irrigation water supply is stable and is the equivalent of that allocated to potato crops alone. It also examined the productivity per m³ of water for a mixed potato-sulla crop in cases where a reduction in nitrogen is applied.

For the tuber yield, although production level remained high (48.8 t/ha), the association of crops caused a drop in the fresh yield by 17.5% and by 20.5% in the dry yield, but without affecting the quality of the production. However, the introduction of sulla brought a recovery of 50% of the cultivated area. It also compensated for the loss in the tuber yield by a fodder production of 10.5 t/ha. Besides this, the association only brought about a small reduction in the overall efficiency of light use (from 1.92 g MS MJ⁻¹ to 1.69 g MS MJ⁻¹) and water use (3.54 to 3.13 kg MS, m⁻³).

Concerning the impact of the reduction in nitrogen on the yield of the association with potatoes, the results obtained show that the tuber yield remained stable at around 47.8 t/ha. As for the fodder yield with sulla, the reduction in nitrogen brought a considerable rise in the yield. Thus, a yield of 22.5 t/ha was obtained on the mixed plot that received a minimum supply of nitrogen (N₀) compared to a yield of 10.5 t/ha when the fertilising programme for potatoes was kept up in the association of crops (N₂). Besides this, the ceasing of nitrogenous fertilisation had positive results on the dry material rate of the sulla, going up from 8.1% MS to 12.6% MS, respectively in the cases of N₂ and N₀ treatment. Thus, a reduction of nitrogen in the association brought about a considerable increase in the total yield of dry materials, greater than that for potatoes alone in the most favourable conditions. This increase in yield permitted improvement in the overall efficiency of water and light use. Indeed, the efficiency of the m³ went up from 3.13 to 3.81 kg MS, m⁻³ of water applied. Thus, compared to a single potato crop grown in standard irrigation and fertilising conditions, an increase of 8.5% in the productivity per m³ of water can be obtained by growing sulla while maintaining the water supply but reducing the nitrogen supply.

This example enables us to conclude that the adopting of a mixed crops system in irrigated areas can constitute a sustainable solution to the increase in foodstuff demand in a context where the water supply will be more and more limited. This improvement in the efficiency of water use, added to the positive solution of mixed crops for environmental problems connected to the growing use of fertilisers and to climatic and epidemic hazards, offers great potential for the stabilising of income which is the sole guarantee for the sustainable development of irrigated agriculture in the Mediterranean.

Contact : Sahli Ali, Institut National Agronomique de Tunisie, sahli_inat_tn@yahoo.fr