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# ABSTRACTS OF PAPERS AND POSTERS

## I PROGRAMME AND ORAL PRESENTATIONS

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## SEED SIZE EFFECTS ON ABOVE-GROUND STEM NUMBER AND YIELD OF POTATO CROP

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### INTRODUCTION

The seed is an important production factor in the potato crop since the seed-tuber has a high price cost in Portugal, where almost the seed is imported. On the other hand, the mean national harvest is low, 15 Mg/ha (FAO, 2005), subjected to adverse environmental conditions, particularly the high temperatures during the cropping season (Rodrigues, 2000). Considering that farmers often sell their crops at a very low price, the production means must be used very rationally. To find the best seed rate is a never ending task since it depends on varieties (Arsenault and Malone, 1999), physiological age of seed tubers (Allen and Wurr, 1992), yield potential of the cropping system (Rodrigues et al., 2004) and also the price of seed and crops. The goal is to find the minimum weight of seed to achieve an adequate plant density allowing maximum tuber yield. From field experiments, started in 1995, we try to establish the adequate plant population to achieve maximum yield and the performance of the different size of seed-tuber or seed pieces. In this work, we stress the results of the last two years (2003 and 2004) where we introduced an innovative methodology consisting on the analysis of the performance of each individual plant cultivated in rows where the weight of the next seed-tuber increases gradually.

### MATERIAL AND METHODS

Field experiments with irrigated potato (*Solanum tuberosum* L.) were conducted at the experimental farm of Sta Apolónia, NE Portugal, during the summer seasons of 2003 and 2004. The soil is sandy loam textured (eutric Cambisol), with 10 mg kg<sup>-1</sup> of organic matter and pH (H<sub>2</sub>O) 5.7. Local climate is Mediterranean type, warm and dry during the summer season. In 2003 and 2004 the cvs Désirée and Kennebec were used. The seed tubers were individually weighed just before the date of plantation and numbered. Forty groups of 8 tubers were separated according to its weight. The first group contained the 8 light tubers and the last group the 8 heavy tubers. Ordering all the 40 groups by weight, 8 rows of 40 tubers were planted, starting with the light tubers and finishing the row with the heavier tubers. The field plots appeared as shown in figure 1.

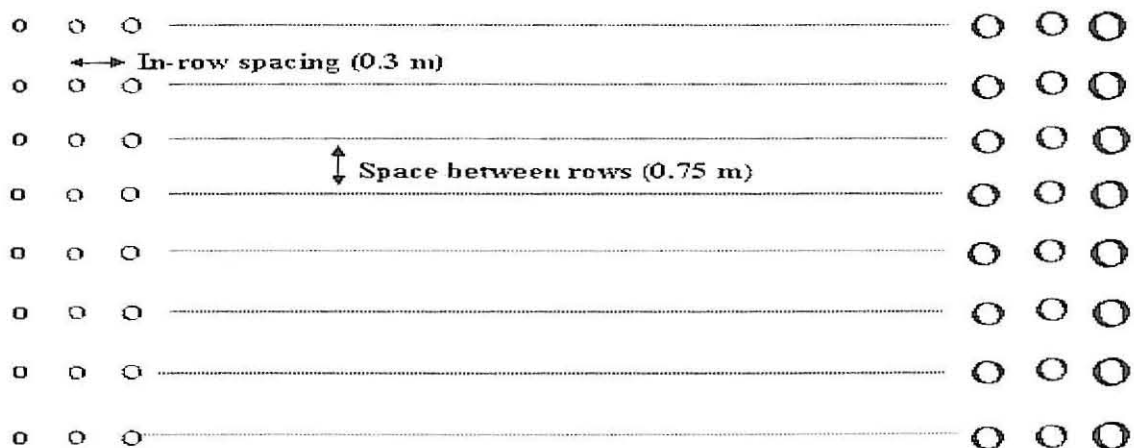


Figure 1. Diagram of spatial distribution of seed-tubers in the field plot. Each emerged plant grows surrounded by others with similar canopy. Along the rows the weight of seed-tubers increases very slightly.

The size 28-50 mm of seed tubers for cv. Désirée and Kennebec were used. Their weights varying between 14.9 to 118.5 g and 16.6 to 142.5 g per seed, respectively. At planting time, the average number of sprouts (> 3mm) per tuber were 2.3 and 2.7 for Désirée and Kennebec, ranging between 0 and 5 for both varieties. The N-, P- and K-fertilisers were applied according to pre-plant soil analysis. Plantation occurred at 10 and 18 April in 2003 and 2004, respectively. The potato was sprinkler irrigated during the season. Weeds, colorado potato beetle and late blight were chemically managed within the rules of integrated crop protection. Seed rate was 44, 444 tubers per ha. The experimental design allows for all plants to grow surrounded by others with similar stem density in so far as the most closer seeds have identical potential to develop a given canopy size. During the season the above-ground stems per plant were accounted. The crop was hand-hoeing harvested and the tuber yields per plant of the six internal rows recorded.

## RESULTS AND DISCUSSION

The influence of seed size on above-ground stem number is shown in figure 2. As the fresh weight per seed increases the greater is the number of above-ground stem, despite the variable range between plants. The increase in stem number is only 2.21 and 2.30 % in regards to the relative fresh seed weight increase for cv Désirée and Kennebec, respectively. Tubers above 120 g could only produce 2 or 3 stems. In the opposite side, tuber weighed 20 to 30 g could produce 5 or 6 main stems. The great variability around the straight line means that many other factors besides the seed size could influence the number of main stems produced by seed unit. Considering that the farmers buy the seed by weight, the bigger the seed-tuber is the lower is the stem number obtained by weight unit of seed.

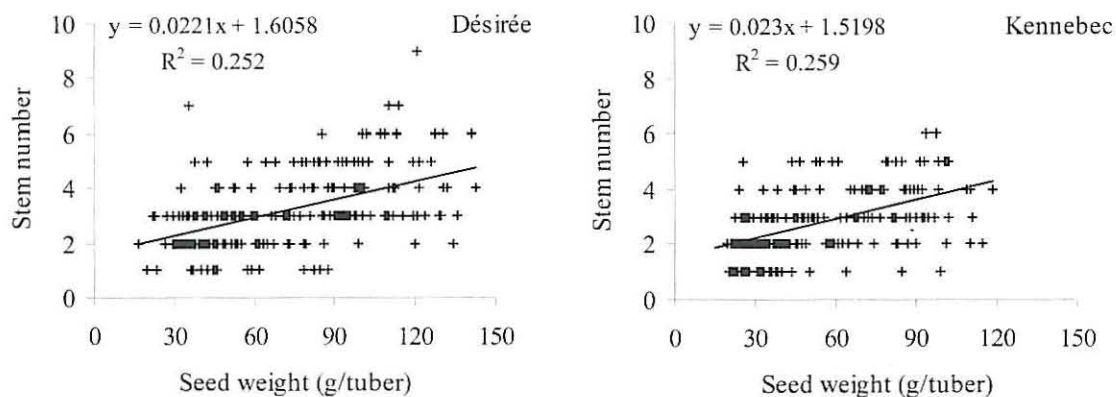


Figure 2 – Relationship between fresh seed weight and above-ground main stems. Each point (+) represents the result of the individual seed-tubers.

The increase on seed weight did not have a positive effect in tuber yield for cv. Désirée (figure 3), despite the slight increase in stem number with the increase in seed size (figure 2). Regarding the cv. Kennebec a significant increase in tuber yield per plant was found when seed size increase (figure 3). The different behaviour between varieties could be justified by the higher yield reached with cv. Kennebec, or eventually due to different pattern in aerial ramification (data not shown). A minimum stem density must be found to achieve maximum yield, and it depends on yield potential of the cropping system (Rodrigues et al., 2004). The slight increase in stem number with seed size is well reported in the literature (Allen and Wurr, 1992).

Organizing the yield results of the different plants as a function of its above-ground stem number, we could witness that the mean yield of plants with 1,2, ..., or 7 stems was not very different (figure 4). A plant with only one above-ground main stem could reach mean tuber yields very similar to plants with 5, 6 or 7 main stems. If the tuber yields were shown by above-ground main stem, the plants with few stems produce significantly more tubers per stem than the plants with higher number (figure 5). Thus,

a great competition between the main stems within the plant seems to occur. Isolated stems produce more tubers than those which compete within the same plant with a higher number of stems (Vander Zaag et al., 1990). The plants were harvested after full senescence of their vines and an initial back-development could be recovered during the long summer season.

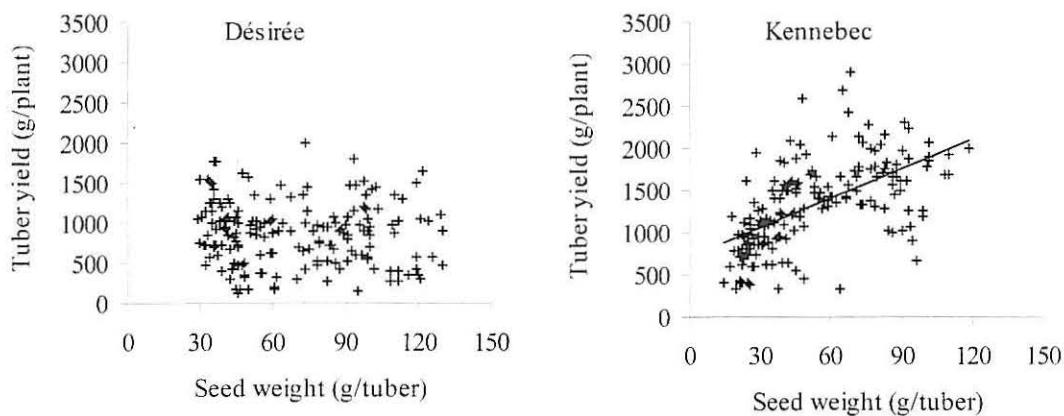


Figure 3 – Relationship between seed-tuber weight and tuber yield per plant.

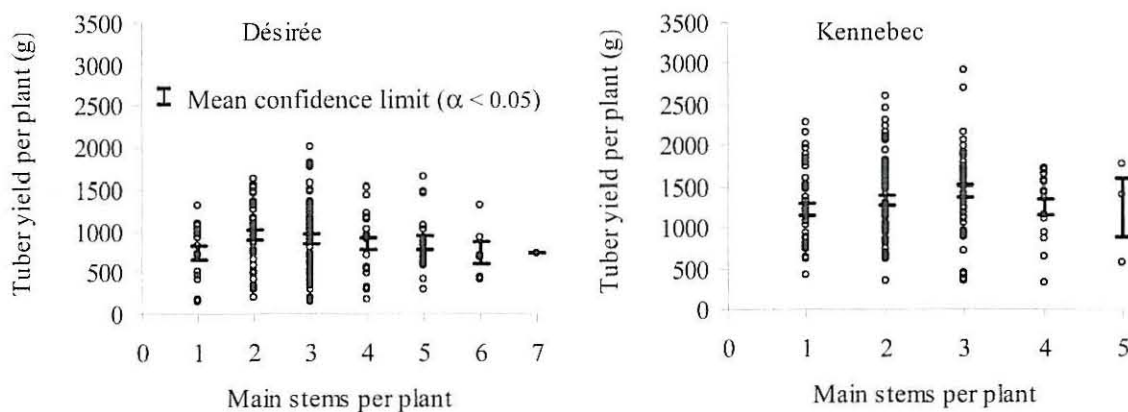


Figure 4 – Tuber yield per plant as a function of its main stem number.

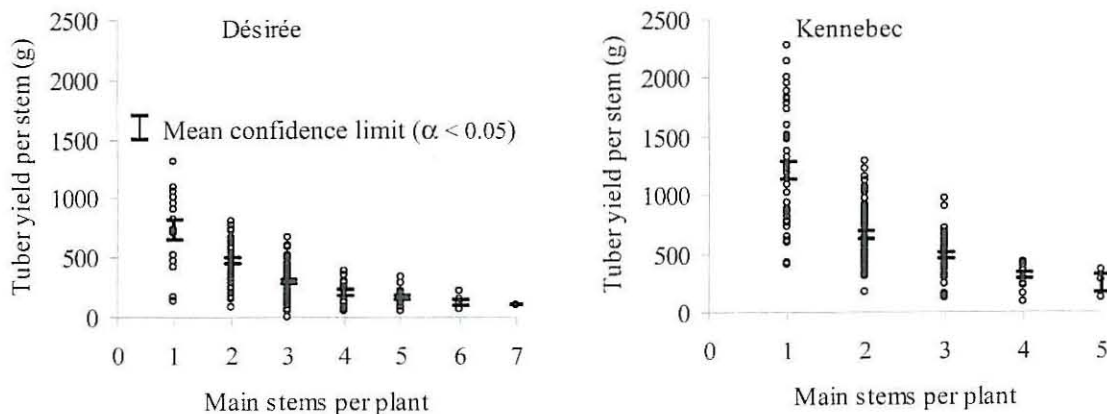


Figure 5 – Tuber yield per above-ground stem as a function of variable number of stems per plant.

The main stem is the unit of planting density (Allen, 1977). The cost of each main stem depends on its seed weight. Each main stem could be particularly expensive, when big seed-tubers produce a reduced number of main stems. Considering that the farmers buy the seed by weight each seed unit has, in practice, a different price. A big tuber is an expensive seed compared to the little seed-tubers. As the seed size increases the lower is the return on invested seed cost.

Between the limits of seed weight used in this work, 14.9 to 118.5 g and 16.7 to 142.5 g for Désirée and Kennebec, as smaller the seed the bigger will be the advantages for farmers (figure 6). However, in order to fully understand the process we need to take into account other aspects, such as the physiological age of seed tuber, sprouting rate and planting density (data not shown in the present work).

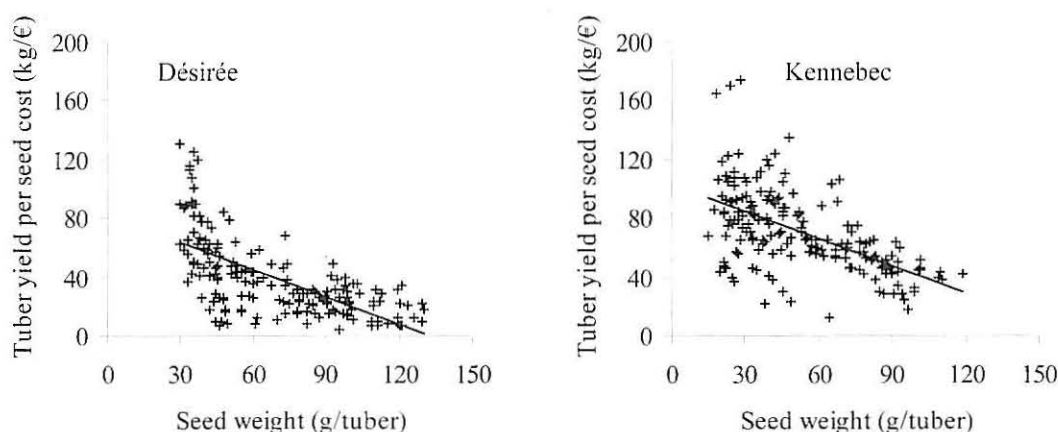


Figure 6 – Tuber weight per seed cost as the seed size increase.

This subject has drawn little attention in Europe, but its importance could be huge in countries that import seed potatoes and where the farmers have to pay a really high price. The subject assumes also a great significance when the yield potential of the cropping system is low and in addition the farmer-price of the crop is also often low. The commercial sizes of seed-potatoes should have very narrow limits to allow for a better adjustment of its price in regards to its agronomic value.

## REFERENCES

- Allen, E. J. 1979. Effects of cutting seed tubers on number of stems and tubers and tuber yields of several potato varieties. *J. Agric. Sci. Camb.*, 93: 121-128.
- Allen, E. J. and Wurr, D. C. C. 1992. Plant density. In: P. M. Harris (ed.). *The Potato Crop. The Scientific Basis for Improvement*. 2<sup>nd</sup> Ed. Chapman & Hall, London.
- Arsenault, W. J. and Malone, A. 1999. Effects of nitrogen fertilization and in-row seedpiece spacing on yield of three potato cultivars in Prince Edward Island. *Amer J of Potato Res*, 76: 227-229.
- FAO. 2005. [www.fao.org](http://www.fao.org) (accessed, Jan. 2005).
- Rodrigues, M. A. 2000. Nitrogen management in potato crop. PhD. Thesis, UTAD, Vila Real.
- Rodrigues, M. A., Martins, F and Coutinho, J. 2004. The effect of seed size, seed-pieces and physiological age of seed tubers on growth and yield of potato crop. *Rev. Ciências Agrárias XXVII (2/4): 28-39.*
- Vander Zaag, P., Demagante, A. L. and Ewing, E. E. 1990. Influence of plant spacing on potato (*Solanum tuberosum* L.) morphology, growth and yield under two contrasting environments. *Potato Res.* 33: 313-323