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RESEARCH ON THE INFLUENCE OF IRRIGATION ON THE NUTRITIONAL QUALITY OF THE SWEET POTATO IN THE CONDITIONS OF THE SANDY SOILS IN THE SOUTH OF OLTENIA

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Abstract. During 2018-2019, research was conducted on the sandy soils of southern Oltenia regarding the influence of irrigation water on sweet potato production and on the nutritional quality of tubers. The experiment took place on a sandy soil with a low to high supply of nitrogen, a high supply of phosphorus, a low supply of potassium, a low to medium supply of organic carbon, and a moderately acidic to neutral reaction. The best production results were obtained under the conditions of 2019, in the irrigated variants with watering norms of 145 m3/ha and 290 m3/ha, over a period of 100 days from plantation (30.18-31,75t / Ha). The increase of the watering norm, as well as of the irrigation period led to the decrease of the production of tubers. The biochemical composition of the tubers was influenced by the amount of water administered through irrigation. The best results were obtained in the variant irrigated with a watering norm of 290 m3/ha up to 100 days after plantation. The irrigation of the crop up to 110 days after plantation led to a decrease in the amount of total dry matter in the tubers. A correlation given by a polynomial equation of the second degree was established between the production of tubers and the amount of total dry matter in the tuber, with a significant distinct correlation factor r = 0.73 **. The quantity of total dry matter in the tubers decreases directly with the increase in the production of tubers. The accumulation of starch in the tubers was influenced differently by the application of water through irrigation, during the two years of study. The starch tends to accumulate, with the increase of the applied water quantity, significantly under the conditions of 2018 and insignificantly in 2019.

Keywords: sweet potato, irrigation, sandy soils, nutritional quality, total dry matter.

Rezumat. Cercetări privind influența irigării asupra calității nutriționale a cartofului dulce în condițiile solurilor nisipoase din sudul Olteniei. În perioada 2018-2019 pe solurile nisipoase din sudul Olteniei au fost efectuate cercetări privind influența irigării asupra producției de cartof dulce, cât și asupra calității nutriționale a tuberculilor. Cele mai bune rezultate de producție au fost obținute în condițiile anului 2019, în variantele irigate cu norme de udare de 145 m^3/ha și 290 m^3/ha, pe o perioadă de 100 zile de la plantat (30.18-31.75 t/ha). Mărirea normei de udare, cât și a perioadei de irigare a condus la scăderea producției de tuberculi. Compoziția biochimică a tuberculilor a fost influențată de cantitatea de apă administrată prin irigare. Cele mai bune rezultate au fost obținute în varianta irigată cu o normă de udare de 290 m^3/ha până la 100 zile de la plantare. Irigarea culturii până la 110 zile de la plantare a condus la scăderea cantității de substanță uscată totală în tuberculi. Între producția de tuberculi și cantitatea de substanță uscată totală din tuberculi a fost stabilită o corelație dată de o ecuație polinomială de gradul doi, cu un factor de corelație dinstinct semnificativ (r=0.73**). Cantitatea de substanță uscată totală din tuberculi scade procentual cu creșterea producției de tuberculi. Acumularea amidonului în tuberculi a fost influențată diferit de aplicarea apei prin irigare, în cei doi ani de studiu. Amidonul are o tendință de acumulare, cu creșterea cantității de apă aplicată, semnificativ în condițiile anului 2018 și nesemnificativ în 2019.

Cuvinte cheie: cartof dulce, irigare, soluri nisipoase, calitate nutrițională, substanță uscată totală.

INTRODUCTION

Globally, sweet potato (*Ipomoea batatas L.*) is an important food crop and is cultivated especially in tropical areas and parts of the world, where temperatures are relatively high (LAURIE, 2004).

Studies have shown that water is the most important limiting factor for sweet potato production and it is possible to increase the level of production through different irrigation methods throughout the growing season (CHOWDHURY et al., 2001; PANIGRAHI et al., 2001; FERREIRA & CARR, 2002).

Global warming, which causes fluctuations in rainfall distribution, may increase the risk of plants being repeatedly exposed to drought (MIYASHITA et al., 2005). Drought frequency will increase in the future, even outside arid and semi-arid regions (CHAVES et al., 2002). Many irrigation experiments have shown that the sweet potato plant is relatively sensitive to moisture stress (FABEIRO et al., 2001; YUAN et al., 2003; KASHYAP & PANDA, 2003; ONDER et al., 2005). Most researchers who report the influence of water stress on sweet potato production analysed its effect on aerial parts (JEFFERIES & MACKERRON, 1987; DEBLONDE et al., 1999; LAHLOU et al., 2003).

The functional relationship between soil moisture and plant growth is essential to optimize irrigation management at different stages of sweet potato growth (DELAZARI et al., 2018). Sweet potatoes are easily drought tolerant and can survive drought during the summer. However, low humidity affects the nutritional quality of the tubers even if the plant resumes growth after water stress (PANEQUE, 1992; ECOPORT, 2010). EKANAYAKE & COLLINS, 2004, showed in Turkey conditions that the amount of total dry matter in tubers decreases with increasing irrigation norm. Despite the relative drought tolerance of sweet potato compared to cereal crops (MOTSA et al., 2015), water limitations greatly affect plant development. The formation of roots on freshly planted shoots is optimal at moisture of 80% of the field capacity, although even at 40% of the field capacity there is still a considerable formation of roots (BELEHU, 2003). The use of water for sweet potato cultivation under complete irrigation in Mozambique was 800 mm, with a yield of tubers of 33 t/ha, compared with the quantity of 360 mm at which a production of 15 t/ha was determined (GOMES & CARR, 2001, 2003). Other studies have confirmed that irrigation can increase yields (GHUMAN & LAL, 1983), but can reduce the concentration of dry matter from tubers (EKANAYAKE & COLLINS, 2004).

Moreover, this plant is more productive than wheat (DUVERNAY et al., 2013). However, climate change and extreme rainfall and drought can affect the productivity and nutritional quality of tubers (SINGH & REDDY, 2011; LEE et al., 2012; DUVERNAY et al., 2013). NOZIPHO et al., 2015, showed that the crop has great potential in light of the imminent challenges associated with drought, as a negative effect of climate change.

Based on these considerations, research was conducted on the sandy soils of Southern Oltenia regarding the influence of irrigation water on sweet potato production, as well as on the nutritional quality of tubers.

MATERIAL AND METHOD

In the period 2018-2019, a two-factor experiment was undertaken on the KSP1 variety of sweet potato, with the following variants:

Factor A - Irrigation period:

- a_1- 100 days after planting;
- a_2- 110 days after planting.

Factor B - Watering norm:

- b_1 - 145 m^3/ha
- b_2- 290 m^3/ha
- b_3- 435 m^3/ha

The planting and maintenance of the plants was carried out following the sweet potato cultivation technology developed by the Research and Development Station for Plant Growing on Sand of Dabuleni. The samples of tubers were collected 120 days after planting, and the following determinations were made in the laboratory:

1. water and total dry matter (TDM) (%) - gravimetric method;
2. soluble dry matter (SDM) (%) - refractometric method;
3. soluble carbohydrates (%) - Fehling Soxhlet method;
4. C vitamin (mg / 100g fresh substance) - iodometric method;
5. starch (%) - gravimetric method;
6. the production of tubers by variant - by weighing, with laboratory balance, DESIS type, with three decimals (error +/- 5/10g).

RESULTS AND DISCUSSIONS

The experience was located on sandy soil with a nitrogen content between 0.07-0.11%, values which indicate a low to moderate supply of nitrogen in the soil (Table 1). The phosphorus content was between 57 ppm and 144 ppm, so the soil was well supplied with extractable phosphorus. The values of the exchangeable potassium (19-45 ppm) indicate low to medium supply. The non-uniformity of the soil was also observed from the results obtained with organic carbon (0.27-1.54%). The pH of the soil showed values ranging from 6.03 to 6.75, indicating a moderately acidic to neutral reaction.

The sweet potato is grown mostly in acidic soils, however, the soil pH of 5.5-6.5 is optimal. The high pH of the soil can produce different diseases in the sweet potato while sweet potato grown in low pH soil suffers from aluminium toxicity (NEDUNCHEZHIYAN & RAY, 2010). The sweet potato is also sensitive to saline and alkaline conditions (DASGUPTA et al., 2006; MUKHERJEE et al., 2006).

Table 1. The chemical composition of the soil in the experiment with irrigation of sweet potato.

Variant		Total nitrogen (%)	Extractable phosphorus (ppm)	Exchangeable potassium (ppm)	Organic carbon (%)	pH in water
Not irrigated		0.10	142	45	1.54	6.65
a_1 - 100 days after planting	b_1 -145 m^3/ha	0.11	144	38	0.74	6.55
	b_2 - 290 m^3/ha	0.08	90	20	0.77	6.70
	b_3 - 435 m^3/ha	0.09	77	21	0.71	6.75
a_2 - 110 days after planting	b_1 -145 m^3/ha	0.08	57	19	0.45	6.20
	b_2 - 290 m^3/ha	0.07	67	26	0.27	6.03
	b_3 - 435 m^3/ha	0.08	62	20	0.81	6.05

Well-drained soils are good for growing sweet potatoes. Sandy soils with clay basement are ideal. Heavy clay soils restrict root development due to compactness, while sandy soils encourage long cylindrical roots (NEDUNCHEZHIYAN & RAY, 2010).

From a climatic point of view, the two years of study differed in terms of both temperature and precipitation values (Table 2). The year 2018 was warmer compared to the year 2019, with average temperature values for the vegetation period of 21 °C, compared to 20.6 °C in 2019. In 2018, the amount of precipitations was 498.2 mm, with significant quantities during the period of July, during the planting period, plant growth and tuber initiation, but with the installation of the drought phenomenon starting with August, when the tuber growth occurs. 2019 was a very dry year, and humidity dropped to 1% up to 1 m depth in the soil.

Table 2. The monthly average air temperature and amount of rainfall during the vegetation period of sweet potato (2018-2019).

The climatic element	Year/ Month	V	VI	VII	VIII	IX	X	Average/ Sum
Average temperature (°C)	2018	20.7	22.5	23.6	25.1	20.5	13.4	21.0
	2019	17.4	23.4	23.8	25.4	20.0	13.5	20.6
Rainfall (mm)	2018	106.6	195.2	148.7	30.0	12.6	5.8	498.2
	2019	53.4	55.4	87.2	54.8	12.0	10.0	272.8

In the two concerned years, the production of tubers was influenced by both the irrigation norm and the climatic conditions. The production obtained in 2018 is presented in table 3. The best results were obtained in the variant a_1b_3 (17 t/ha), , with an increase in production compared to the control variant of 7.67 t/ha.

Due to the large amount of precipitations recorded during May - July (450.9 mm), the plants had optimal conditions for the growth of the vegetative part, to the detriment of the formation and thickening of the roots. The installation of a period of intense drought between August and September, with maximum temperatures over 30 °C, led to the installation of thermal water stress on plants and even the application of water through irrigation was not beneficial for obtaining high yields.

BOURKE (2005) and BISWAL (2008) showed that, extended wet periods lead to reduced root yield and have been frequently associated with lush vegetative growth.

Table 3. Production of tubers according to irrigation regime (2018).

Variant		Production (t / ha)	Relative production (%)	The difference from the control culture	Significance
Not irrigated		9.33	100	control culture	
a_1 - 100 days after planting	b_1 -145 m^3/ha	10.00	107.2	0.67	
	b_2 - 290 m^3/ha	12.06	129.2	2.73	**
	b_3 - 435 m^3/ha	17.00	182.2	7.67	***
a_2 - 110 days after planting	b_1 -145 m^3/ha	11.32	121.3	1.99	**
	b_2 - 290 m^3/ha	10.83	116.0	1.50	*
	b_3 - 435 m^3/ha	10.66	114.2	1.33	*

DL5%-1.164 DL 1% -1.634 DL 0,1% -2.306

In 2019, a very dry and hot year, the sweet potato crop was irrigated since planting. The production results are presented in table 4.

The best results were obtained in the variants a_1b_1 and a_1b_2 (30.18-31.75t/ha). Increasing the irrigation norm as well as the irrigation period led to a decrease in tuber production.

The sweet potato can tolerate drought to some extent, but cannot withstand the lack of water (NEDUNCHEZHIYAN & RAY, 2010).

Table 4. Production of tubers according to irrigation regime (2019).

Variant		Production (t / ha)	Relative production (%)	The difference from the control culture	Significance
Not irrigated		16.48	100	control culture	
a_1 - 100 days after planting	b_1 -145 m^3/ha	30.18	183.1	13.70	**
	b_2 - 290 m^3/ha	31.75	192.6	15.30	**
	b_3 - 435 m^3/ha	24.96	151.5	8.48	*
a_2 - 110 days after planting	b_1 -145 m^3/ha	22.30	135.3	5.82	
	b_2 - 290 m^3/ha	21.69	131.6	5.21	
	b_3 - 435 m^3/ha	22.06	133.8	5.58	

DL5%-8.18; DL 1% -11.48; DL 0,1% -16.21

The biochemical composition of sweet potato tubers, according to the irrigation norm in 2018, is presented in table 5. The total dry matter varied between 36.82 % in variant a_2b_1 and 42.50 % in a_1b_2. The irrigation of plants up to 110 days after planting, irrespective of the amount of water, led to a decrease in the total dry matter content and increase in the water quantity.

A larger amount of water in the tubers can pose problems for storage, but also intensify the dehydration process. The soluble dry matter in the tubers was influenced by the amount of water applied by irrigation. The largest quantity was determined in the non-irrigated version (12.7%). Increasing the irrigation norm led to the decrease of the soluble dry matter in the tubers. Also, the amount of carbohydrates in the tubers decreased with the increasing amount of water.

Table 5. Biochemical composition of sweet potato tubers according to irrigation regime (2018).

Variant		Total dry matter (TDM) (%)	Soluble dry matter (SDM) (%)	Soluble carbohydrates (%)	Starch (%)	C vitamin (mg/100g f.s*)
Not irrigated		39.10	12.7	10.56	11.97	10.56
a_1 - 100 days after planting	b_1 -145 m^3/ha	40.67	12.3	10.21	12.20	12.32
	b_2 - 290 m^3/ha	42.50	12.0	10.00	12.15	14.08
	b_3 - 435 m^3/ha	41.71	11.6	9.65	12.36	12.32
a_2 - 110 days after planting	b_1 -145 m^3/ha	36.82	10.9	9.00	12.45	13.20
	b_2 - 290 m^3/ha	39.50	11.8	9.80	12.53	11.44
	b_3 - 435 m^3/ha	38.70	11.5	9.60	13.25	11.32

f.s* - fresh substance

The amount of starch in sweet potato tubers was influenced by the irrigation norm and showed an increase from 11.97 % in the not irrigated version to 13.25 % in the variant a_2b_3.

The C vitamin content of sweet potato tubers was influenced by the amount of water applied by irrigation. The values were between 10.56 mg in the not irrigated version and 14.08 mg in the variant a_1b_2.

In the climatic conditions of the year 2019, a very dry and warm year, the irrigation of the sweet potato was very necessary in all the phases of vegetation. The results regarding the nutritional quality of the sweet potato according to irrigation are presented in table 6. A total dry matter content was determined for sweet potato tubers, ranging from 25.33 % in the variant a_2b_3 to 36.91 % in the variant a_1b_2.

Table 6. The biochemical composition of sweet potato tubers according to irrigation (2019).

Variant		Total dry matter (TDM) (%)	Soluble dry matter (SDM) (%)	Soluble carbohydrates (%)	Starch (%)	C vitamin (mg/100g f.s*)
Not irrigated		33.78	8.70	7.50	13.34	10.15
a_1 - 100 days after planting	b_1 -145 m^3/ha	31.37	8.80	7.60	12.20	9.68
	b_2 - 290 m^3/ha	36.91	6.90	5.95	13.08	10.56
	b_3 - 435 m^3/ha	33.12	7.00	6.00	13.52	9.68
a_2 - 110 days after planting	b_1 -145 m^3/ha	26.90	7.60	6.55	13.65	9.68
	b_2 - 290 m^3/ha	26.64	6.10	5.25	13.62	8.80
	b_3 - 435 m^3/ha	25.33	6.80	5.85	13.80	9.60

f.s* - fresh substance

A correlation given by a polynomial equation of the second degree was established between the production of tubers and the amount of total dry matter in the tubers, with a significant correlation factor (r = 0.73 **). The amount of total dry matter in the tubers decreases as the tuber production increases (Fig. 1).

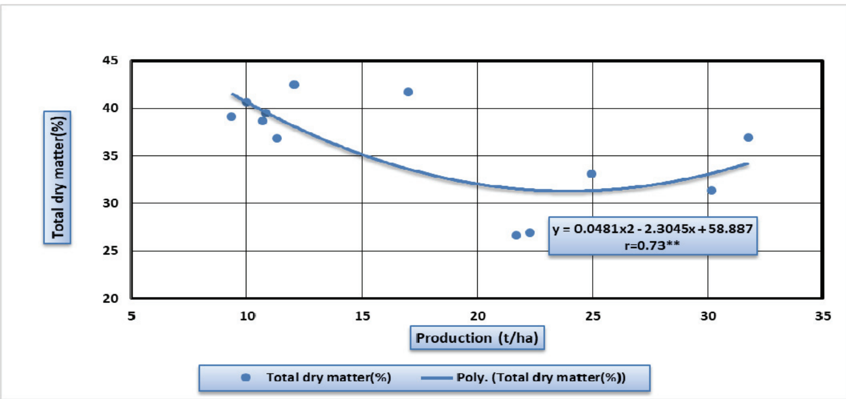
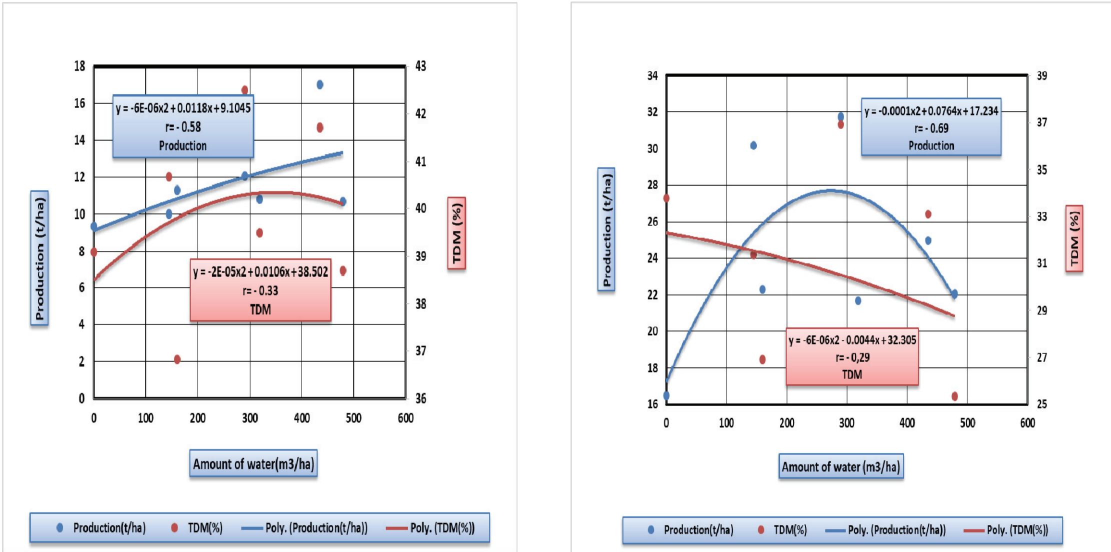


Figure 1. The correlation between the production of tubers and the amount of total dry matter in the tubers.

Both the production of tubers and the amount of dry matter in the tubers are not significantly influenced by the amount of water administered (Fig. 2). In 2018, both the production and the total dry matter of the tubers have an insignificant tendency of growth, with the increase of the quantity of water administered by irrigation only up to 100 days after planting (the correlations are positive) (Fig. 2a). In the climatic conditions of the year 2019, both the production and the dry matter of the tubers decrease insignificantly with the increase of the quantity of water, although the production of the tubers is much higher than in 2018 (Fig. 2b).

These results are similar to those obtained by GHUMAN & LAL, 1983, who showed that irrigation can increase yields but reduces the concentration of dry matter at the roots (EKANAYAKE & COLLINS, 2004). Also, EKANAYAKE & COLLINS, 2004, showed in the conditions of Turkey that the amount of total dry matter in the tubers decreases with the increase of the irrigation norm.



a b

Figure 2. The correlations between the quantity of water applied by irrigation, the production of tubers and the quantity of dry matter from the tubers in the conditions of the year 2018 (a) and 2019 (b).

The accumulation of starch from the tubers was influenced differently by the application of irrigation water during the two years of study. The tendency to accumulate with the increase of the quantity of applied water id significant under the conditions of 2018 and insignificant in 2019 (Fig. 3).

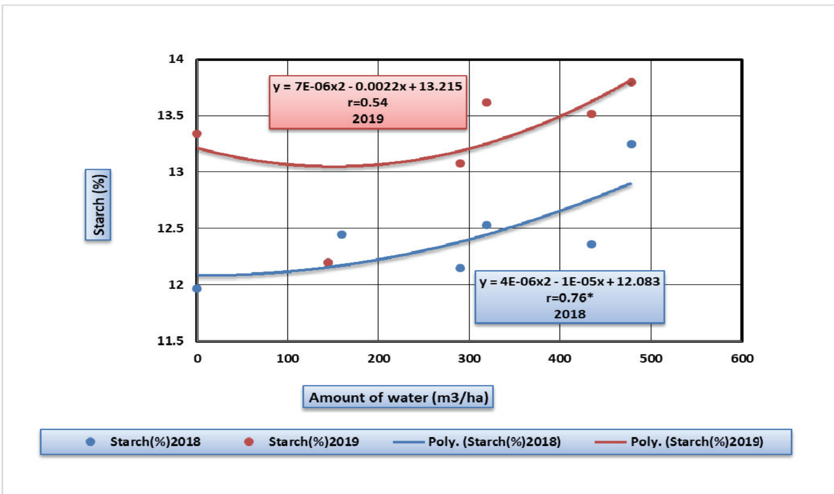


Figure 3. Correlations between the amount of water applied by irrigation and the quantity of starch in the tubers.

All these results indicate that the sweet potato plant is drought tolerant and can survive drought during the summer. However, low humidity affects both the production and the quality of the tubers. The results obtained are similar to those obtained by PANEQUE, 1992; ECOPORT, 2010; GAJANAYAKE et al., 2014, etc.

CONCLUSIONS

- The sweet potato capitalizes with good results the eco-pedological conditions in the area of sandy soils, in irrigated cultures
- The best production results were obtained under the conditions of 2019, in the variants irrigated with 145 m^3/ha and 290 m^3/ha, over a period of 100 days after planting (30.18-31.75t/ha). The increase of the irrigation norm as well as the irrigation period led to the decrease of the tuber production.
- The alternation of periods with quantitatively significant precipitations (450.9 mm in May-June 2018) with periods of heat and drought led to a low production, due to the growth of the vegetative part, to the detriment of root formation and thickening.

- The biochemical composition of the tubers was influenced by the amount of water administered by irrigation. The best results were obtained under the conditions of 2018, in the irrigated version with 290 m^3/ha up to 100 days after planting.
- The irrigation of the crop up to 110 days after planting led to a decrease in the amount of total dry matter in the tubers.

REFERENCES

BELEHU T. 2003. Agronomical and physiological factors affecting growth, development and yield of sweet potato in Ethiopia. *Plant production and Soil Science.* Edit. University of Pretoria. Africa de Sud: 213.

BISWAL S. 2008. Response of sweet potato (*Ipomoea batatas* L.) to irrigation and fertility levels. *Orissa Agricultural University and Technology*. Bhubaneswar. India: 218.

BOURKE R. M. 2005. Recent research on sweet potato and cassava in Papua New Guinea. *In: Acta Horticulture Journal*: *Concise Papers of the 2nd International Symposium on Sweet Potato and Cassava*. International Society for Horticultural Science. Kuala Lumpur: 125-126.

CHAVES M. M., PEREIRA J. S., MAROCO J., RODRIGUES M. L., RICARDO C. P. P., OSÓRIO M. L. 2002. How plants cope with water stress in the field. Photosynthesis and growth. *Annals of Botany*. Oxford University Press. London. **89**: 907-916.

CHOWDHURY S. R., AATONY E., SINGH R., THAKUR A. K., VERMA H. N. 2001. Leaf area development and its relationship with tuber yield in sweet potato under different irrigation regimes. *Orissa Journal of Horticulture*. Orissa Horticultural Society. Bhubaneswar. New Delhi. **29**: 20-23.

DASGUPTA M., KOLE P. C., SAHOO M. R., MUKHERJEE A. 2006. Screening of sweet potato genotypes for salinity stress. *In: 14th Triennial Symposium for International Society for Tropical Root Crops*. Publisher Central Tuber Crops Research Institute. New Delhi: 166-167.

DEBLONDE P. M. K., HAVERKORT A. J., LEDENT J. F. 1999. Responses of early and late potato cultivars to moderate drought conditions: agronomic parameters and carbon isotope discrimination. *European Journal of Agronomy*. Elsevier. London. **11**(2): 91-105.

DELAZARI F. T, ASSIS I. R., CABRERA D. F. V., FERREIRA M. G., DIAS L. E., RUEDA ANGELICA, ZANUNCIO J. C., SILVA DERLY J. H. 2018. Morpho-physiological characteristics by sweet potato cultivars as function of irrigation depth. *Academia Brasileira de Ciências*. Rio de Janeiro. **90**(4): 3541-3549.

DUVERNAY W. H., CHINN M. S., YENCHO G. C. 2013. Hydrolysis and fermentation of sweet potatoes for production of fermentable sugars and ethanol. *Industrial Crops and Products*. Elsevier. Paris. **42**: 527-537.

EKANAYAKE I. J. & COLLINS W. 2004. Effect of irrigation on sweet potato root carbohydrates and nitrogenous compounds. *Journal of Food Agriculture and. Environment*. WFL publisher Science and Technology. London. **2**(1): 243-248.

FABEIRO C., DE SANTA OLALLA F. M., DE JUAN J. A. 2001. Yield and size of deficit irrigated potatoes. *Agricultural Water Management*. Elsevier. Paris. **48**(3): 255-266.

FERREIRA T. C. & CARR M. K. V. 2002. Responses of potatoes (*Solanum tuberosum* L.) to irrigation and nitrogen in a hot, dry climate: I. Water use. *Field Crops Research*. Elsevier. Paris. **78**(1): 51-64.

GAJANAYAKE B., REDDY K. R., SHANKLE M. W., ARANCIBIA R. A. 2014. Growth, development, and physiological responses of two sweet potato (*Ipomoea batatas* L.) cultivars to early season soil moisture deficit. *Scientia Horticulturae*. Elsevier. Paris. **168**: 218-228.

GHUMAN B. S. & LAL R. 1983. Mulch and irrigation effects on plant-water relations and performance of cassava and sweet potato. *Field Crops Research*. Elsevier. Paris. **7**: 13-29.

GOMES F. & CARR M. K. V. 2001. Effects of water availability and vine harvesting frequency on the productivity of sweet potato in Southern Mozambique in storage root and vine yields. *Experimental Agriculture*. Cambridge University Press. London. **37**(4): 523-537.

GOMES F. & CARR M. K. V. 2003. Effects of water availability and vine harvesting frequency on the productivity of sweet potato in southern Mozambique. II. Crop water use. *Experimental Agriculture*. Cambridge University Press. London. **39**(1): 39-54.

JEFFERIES R. A. & MACKERRON D. K. L. 1987. Aspects of the physiological basis of cultivar differences in yield of potato under droughted and irrigated conditions. *Potato Research*. Springer. Editor-in-Chief: Paul Struik. Berlin. **30**: 201-217.

KASHYAP P. S. & PANDA R. K. 2003. Effect of irrigation scheduling on potato crop parameters under water stressed conditions. *Agricultural Water Management*. Elsevier. Paris. **59**(1): 49-66.

LAHLOU O., OUATTAR S., LEDENT J. F. 2003. The effect of drought and cultivar on growth parameters, yield and yield components of potato. *Agronomie*. Édition Diffusion Presse Sciences. Paris. **23**(3): 257-268.

LAURIE SUNETTE M., VAN DEN BERG A. A., MAGORO M. D., KGONYANE M. C. 2004. Breeding of sweetpotato and evaluation of imported cultivars in South Africa. *African Crop Science Journal*. African Crop Science Society. Uganda. **12**(3): 189-196.

LEE W. S., CHEN I. C., CHANG C. H., YANG S. S. 2012. Bioethanol production from sweet potato by co-immobilization of saccharolytic molds and *Saccharomyces cerevisiae*. *Renewable Energy*. Elsevier. Paris. **39**(1): 216-222.

MIYASHITA K., TANAKAMARU S., KIMURA K. 2005. Recovery responses of photosynthesis, transpiration, and stomatal conductance in kidney bean following drought stress. *Environmental and Experimental Botany*. Elsevier. Paris. **53**(2): 205-214.

MOTSA N. M., MODI A. T., MABHAUDHI T. 2015. Sweet potato (*Ipomoea batatas* L.) as a drought tolerant and food security crop. *South African Journal of Science*. Academy of Science for South Africa. Africa. **111**: 1-8.

MUKHERJEE A., NASKAR S. K., EDISON S., DASGUPTA M. 2006. Response of orange flesh sweet potato genotypes to salinity stress. *In: 14th Triennial Symposium for International Society for Tropical Root Crops*. Publisher Central Tuber Crops Research Institute. New Delhi: 151-152.

NEDUNCHEZHIYAN M. & RAY R. C. 2010. Sweet potato growth, development production and utilization: overview. *Post Harvest Aspects in Food*. Nova Science Publishers. New York: 1-26.

NOZIPHO M. M., ALBERT T. M., MABHAUDHI T. 2015. Sweet potato (*Ipomoea batatas* L.) as a drought tolerant and food security crop. *South African Journal of Science*. Academy of Science of South Africa. **111**(11-12): 1-8.

ONDER S., CALISKAN M. E., ONDER D., CALISKAN S. 2005. Different irrigation methods and water stress effects on potato yield components. *Agricultural Water Management*. Elsevier. Paris. **73**(1): 73-86.

PANEQUE R. 1992. Cultivation harvesting and storage of sweet potato products. In: Roots, tubers, plantains and bananas in animal feeding. *Food and Agriculture Organization Animal Production and Health Paper*. Elsevier. Paris. **95**: 15-23.

PANIGRAHI B., PANDA S., RAGHUWANSHI N. 2001. Potato water use and yield under furrow irrigation. *Irrigation Science*. Springer. Berlin. **20**: 155-163.

SINGH S. K. & REDDY K. R. 2011. Regulation of photosynthesis, fluorescence, stomatal conductance and water-use efficiency of cowpea (*Vigna unguiculata* [L.] Walp.) under drought. *Journal of Photochemistry and Photobiology B: Biology*. Elsevier. Paris. **105**(1): 40-50.

YUAN B. Z., NISHIYAMA S., KANG Y. 2003. Effects of different irrigation regimes on the growth and yield of drip-irrigated potato. *Agricultural Water Management*. Elsevier. Paris. **63**: 153-167.

***. ECOPORT, 2010. Ecoport database. Ecoport. *Feedipedia*. http://www.ecoport.org. (accessed: April 15, 2019).

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