Bioscience Journal Original Article

NUTRIENT UPTAKE IN SESAME CULTIVARS UNDER CULTIVATION IN SEMIARID CONDITIONS

ACÚMULO DE NUTRIENTES EM CULTIVARES DE GERGELIM SOB CULTIVO EM CONDIÇÕES SEMIÁRIDAS

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ABSTRACT: Sesame is considered the oldest oleaginous seed in use by mankind. It is a culture of high morphophysiological complexity with great variability in growth habit. The accumulation of nutrients in the sesame crop is, in relative terms, proportional to its average productivity. It is a crop that requires the availability of sufficient amounts of nitrogen, phosphorus and potassium to obtain a desired yield. Thus, the aim of this study was to assess the uptake of nutrients for sesame cultivars in two growing seasons conditions semiarid. The experiments were performed in Horta Didatics of Universidade Federal Rural do Semi-Árido, in Brazil, from November 2014 to February 2015 (Growing Season I); and from April to July 2015 (Growing Season II). The experimental design was a randomized complete block design with four replications. Treatments were arranged in a split plot where cultivars (CNPA G2, CNPA G3, and CNPA G4) were placed on the following plots with harvesting dates 21, 35, 49, 63, 77, 91, and 105 days after sowing (DAS) of subplots. The vegetative part of the sesame crop had greater uptake of potassium in Growing Season I (the period from November 2014 to February 2015) and of nitrogen in Growing Season II (the period from April to July 2015) for all the cultivars, whereas in the fruits the greatest uptake was that of nitrogen, independent of growing season. As for the total uptake of nutrients at the end of the cycle, it followed the descending order N > K > P in both growing seasons. The period of greatest demand for nutrients occurred between 77 and 105 DAS. In relation to the cultivars, the CNPA G3 obtained larger uptakes in Growing Season I (the period from November 2014 to February 2015), while the CNPA G4 did so in Growing Season II (the period from November 2014 to February 2015).

KEYWORDS: *Sesamum indicum.* Macronutrients. Collection season.

INTRODUCTION

Sesame *(Sesamum indicum* L.) is adapted to various weather conditions, drought tolerant, and easy to grow. World production in 2014 was estimated at 5,469,024 tons, the main producing countries being India, Sudan, and China. Brazil is considered a small producer, with just 7 tons in 2014 (FAO, 2016). In the Northeastern region of Brazil, sesame is the predominant crop at a subsistence level, but is considered an alternative of great economic and social importance because of its exploiting characteristics, with potential to generate income and labor for small and medium producers. The main crop product is the seed, rich in protein and in edible oil of great stability (ARRIEL; CARDOSO, 2011). In the food industry it is used in the manufacture of breads, biscuits, margarines and sweets, and it is used in home cooking as well. The oil is also widely used in the pharmaceutical industry and in the production of cosmetics and perfumes and has great potential for biodiesel production (BELTRÃO; OLIVEIRA, 2011).

The study of the uptake of nutrients in the sesame crop cycle is one of the main tools for good planning of fertilization, determined from the total amount of nutrients absorbed by plants. The optimal nutrient intake curve should define the optimal amount that the plant needs without deficiency or excess of nutrients, as excess nutrients do not contribute to an improvement in productivity, besides reducing fertilization costs (KURIHARA et al., 2016; GALATI et al., 2013; GRANGEIRO et al., 2011).

The behavior of cultures and nutrients are differentiated depending on the location, planting dates, and cultivars, showing the need for studies in

Received: 18/08/17
Accepted: 05/10/18

http://dx.doi.org/10.14393/BJ-v35n1a2019-39468

different places where sesame is cultivated (SHILPI et al., 2014). Santos et al. (1982), studying mineral nutrition of sesame, verified that the accumulation of macronutrients is always higher in the vegetative part of the plant, except for potassium, the concentration of which decreases with the age of the plants, mainly from the beginning of the flourishing of culture. Results verified by Corrêa et al. (1995), working with Sesame, cultivar Jori, found that nutrient extraction up to 98 days of emergence followed the order leaf (N > Ca > Mg > S > P), stem (K > CA > N > Mg > S > P), and fruit (N > K > Ca > Mg > S > P), and that maximum nutrient extraction occurs at 74 and 86 days after plant emergence.

The crop absorbs little nitrogen (N), phosphorus (P), and potassium (K) up to 30 days after planting, and then the plant's need for such nutrients grows rapidly, reaching a maximum demand of N at 74 days, P from 60 to 90 days, and K after 35 days, and grows until the end of the cycle. On average, the plant needs 50 kg ha^{-1} of N, 14 kg ha^{-1} of P_2O_5, and 60 kg ha^{-1} of K_2O to produce 1,000 kg ha^{-1} of seeds. The fruits correspond to a percentage ranging from 33% to 60% of the extracted NPK. Thus, to ensure the productivity of posterior plantations, these nutrient quantities need to be added through fertilization (ARRIEL et al., 2007).

Studies related to the uptake of nutrients in sesame culture are of great importance; however, there are few results of research on fertilization and nutrition, especially in the Northeast region of Brazil. Thus, the aim of this study was to assess nutrient uptake of sesame cultivars in two growing seasons under semiarid conditions.

MATERIAL AND METHODS

The experiments were conducted in Horta Didatics of Center for Agrarian Sciences of Universidade Federal Rural do Semi-Árido in Mossoró-RN (5° 11' de latitude S, 37° 20' de longitude WGr e altitude de 18 m), Brazil, during the period from November 2014 to February 2015 (Growing Season I) and from April to July 2015 (Growing Season II). Soil chemical characteristics (depth of 0-20 cm) in Growing Seasons I and II, respectively, were: pH = 7.90 and 7.75; electric conductivity = 0.17 and 0.09 dS m^{-1}; N = 0.98 and 1.23 g kg^{-1}; organic matter = 14.11 and 15.60 g kg^{-1}; K = 181.04 and 155.20 mg dm^{-3}; P = 197.09 and 201.95 mg dm^{-3}; Na = 98.05 and 39.50 mg dm^{-3}; Ca = 4.88 and 5.22 cmolc dm^{-3}; and Mg = 0.37 and 1.55 cmolc dm^{-3}. During the conduct of experiments, maximum temperature, and minimum and relative humidity were 35.50 ºC, 23.27 ºC, and 62.47% (November 2014 to February 2015) and 34.78 ºC, 22.03 ºC, and 64.95% (April to July 2015), respectively.

A complete randomized block design with four replications was used. The treatments were arranged in a split plot, where cultivars (CNPA G2, CNPA G3 and CNPA G4) were placed on plots on harvesting dates 21, 35, 49, 63, 77, 91, and 105 days after sowing (DAS) of subplots. Each plot consisted of four rows of plants totaling an area of 7.2 m^2, the useful area being the two central rows (1.44 m^2). The spacing was 0.30 m between plants and 0.60 m between rows, with two plants per hole (population 111,111 plants ha^{-1}).

Soil preparation consisted of plowing and harrowing. The fertilization was performed according to soil analysis and fertilization recommendation for sesame culture according to Cavalcanti et al. (2008), using (in both planting experiments): 40 kg ha^{-1} of P_2O_5 in the form of monoammonium phosphate and two covers, at 10 DAS with 25 kg ha^{-1} of N, and at 20 DAS with 25 kg ha^{-1} of N, and 20 kg ha^{-1} of K_2O, in the form of urea and potassium sulfate. A drip irrigation system was used, placing a hose in each planting row with drippers spaced at 0.30 m, with an average rate of 1.5 L h^{-1}. The control of this was done manually with hoes in the plots. The other cultural treatments were according to the rementioned recommendation for culture (Cavalcanti et al., 2008).

To quantify plant dry mass, ten plants per plot were sampled on the first two harvestings dates (21 and 35 DAS), and one plant in the others (49, 63, 77, 91, and 105 DAS). After each sampling, plants were separated into the vegetative part (stem + leaves) and the fruit (with seeds), washed and separately placed in paper bags, then placed in a forced-air circulation oven at 65 º C until constant weigh was achieved (MENDOZA-CORTEZ et al., 2014). The material was ground and crushed to determine N, P, and K, nitrogen was quantified by the semi-micro Kjeldahl method, phosphorus calorimetrically, and potassium by flame emission photometry (TEDESCO et al., 1995). The contents of each nutrient (kg ha^{-1}) were multiplied by dry weight of the relative fraction to obtain the respective uptakes.

For each growing season, the analyses of variance for the assessed characteristics were conducted through SISVAR 3.01 (FERREIRA, 2011). A joint analysis was performed for the characteristics evaluated with homogeneity of variances between the growing seasons through analysis of the residual mean squares of the individual analyzes according to Hartley (1950). Adjustment procedure of response curves was done for the assessed characteristics and the quantitative factors (SYSTAT SOFTWARE, 2011). Tukey's test ($p < 0.05$) was used to compare the means of the qualitative treatment.

RESULTS AND DISCUSSION

The homogeneity of variances was accepted for all assessed characteristics, with a combined analysis of experiments, with interaction for characteristics, except for the phosphorus uptake in the vegetative part and the fruit, with a separate analysis for each growing season.

Plant dry matter accumulation was slow to 49 days, expanding later for all cultivars. The initial slow growth is due to the great spend of energy for fixation in the ground, where the roots are the preferred drain of photoassimilates (LUCENA et al., 2013). The estim ated maximum uptake for Growing Season I was 104.27 g plant^{-1} (CNPA G2), obtained at 93 DAS; 145.66 (CNPA G3) and 145.81 g plant^{-1} (CNPA G4), both at 105 DAS (Figure 1A, 1C and 1E). For Growing Season II, this was 90.46 (CNPA G2), 72.87 (CNPA G3), and 122.02 g plant^{-1} (CNPA G4) at 105 DAS (Figure 1B, 1D, and 1F). Regarding cultivars, in Growing Season I, a significant difference was found for plant dry mass from 49 DAS, where CNPA G3 and CNPA G4 had higher uptakes at 105 DAS. In Growing Season II, there was a significant difference between cultivars from 77 DAS, and CNPA G4 was higher than the others, with maximum dry matter uptake at 105 DAS.

Maximum dry matter estimated uptakes of the vegetative parts were 74.17 g plant^{-1} (CNPA G2), obtained after 88 DAS; 107.32 (CNPA G3) and 95.19 g plant^{-1} (CNPA G4), both at 105 DAS in Growing Season I (Figure 1A, 1C and 1E); and 58.26 (CNPA G2), 47.85 (CNPA G3), and 67.96 g plant^{-1} (CNPA G4), obtained at 105 DAS in Growing Season II (Figure 1B, 1D, and 1F). In relation to the cultivars, this one obtained greater accumulation of dry mass in the vegetative part in Growing Season I, probably at a time when the cultivars had a bigger growth and greater leaf cover, due to the lodging of some plants and early fall of the leaves in Growing Season II.

In the dry mass of fruit, there was growing uptake up to 105 DAS in both growing seasons, except for CNPA G4 in Growing Season I. The estimated maximums were 29.14 (CNPA G2), 30.16 (CNPA G3), and 58.05 g plant^{-1} (CNPA G4) for Growing Season I (Figure 1A, 1C and 1E); and 31.31 (CNPA G2), 23.73 (CNPA G3), and 54.60 g plant^{-1} (CNPA G4) for Growing Season II (Figure 1B, 1D and 1F). CNPA G4 showed higher dry matter uptake in fruit at 100 DAS of Growing Season I, and at 105 DAS of Growing Season II, which was also the most productive. The cultivar G3 showed lower accumulation of dry mass of fruits due to lower productivity and number of fruits per plant occasioned in Growing Season II.

At the end of the cycle, the dry matter partition in sesame cultivars occurred in Growing Season I for CNPA G2 69.0% vegetative part and 31.0% fruit; CNPA G3 74.7% vegetative part and 25.3% fruit; and CNPA G4 66.0% vegetative and 34.0% fruit. In Growing Season II, it occurred for CNPA G2 64.0% vegetative part and 36.0% fruit; CNPA G3 65.0% vegetative and 35.0% fruit; and CNPA G4 55.4% vegetative part and 44.6% fruit. The accumulation of dry mass in Growing Season II was lower due to the greater precipitation that occurred during the cultivation, besides the winds that caused the lodging of the plants. Similar results were found by Couch et al. (2017), studying nitrogen accumulation, partition, and remobilization by several sesame cultivars in the humid southeast of the USA, showing that 50%–73% and 16%–43% of the accumulated dry mass were allocated to the vegetative and reproductive part, respectively.

Nitrogen uptake was slow at the beginning of development, enhancing from the 35th DAS. The estimated maximum nitrogen plant uptake for Growing Season I was 1.64 g plant^{-1} at 94 DAS (CNPA G2); 2.36 g plant^{-1} at 105 DAS (CNPA G3); and 2.27 g plant^{-1} at 105 DAS (CNPA G4) (Figure 2A, 2C, and 2E). In Growing Season II, 1.13 g plant^{-1} at 88 DAS (CNPA G2); 0.98 g plant^{-1} to 105 DAS (CNPA G3); and 1.75 g plant^{-1} at 105 DAS (CNPA G4) (Figure 2B, 2D and, 2F).

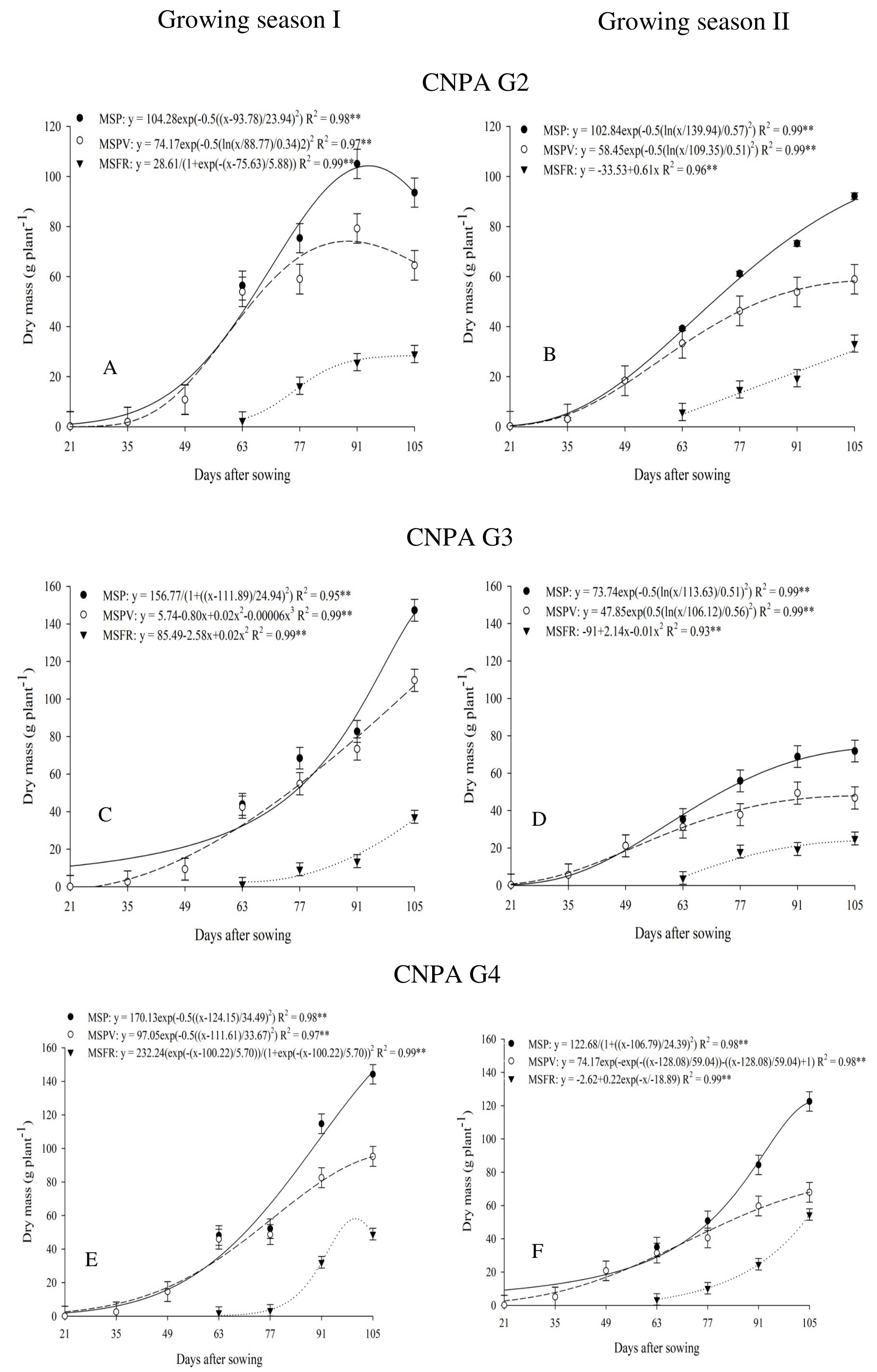

Figure 1. Dry mass in relation to the harvesting dates of cultivars CNPA G2 in Growing Season I (A) and Growing Season II (B); CNPA G3 in Growing Season I (C) and Growing Season II (D); CNA G4 in Growing Season I (E) and Growing Season II (F). MSP: dry mass of the plant; MSPV: dry mass of the vegetative part; MSFR: fruit dry mass.

The vegetative part of the build-up of estimated maximum nitrogen for Growing Season I was 1.19 g plant^{-1} at 88 DAS (CNPA G2); 1.60 g plant^{-1} at 105 DAS (CNPA G3); and 1.31 g plant^{-1} at 85 DAS (CNPA G4) (Figure 2A, 2C and 2E). In Growing Season II, it was 0.85 g plant^{-1} after 67 DAS (CNPA G2); 0.81 g plant^{-1} at 67 DAS (CNPA G3); and 0.80 g plant^{-1} at 70 DAS (CNPA G4) (Figure 2B, 2D and 2F).

In two cropping seasons, a significant difference was found between cultivars in the uptake of nitrogen in the vegetative part at 35 DAS, whereas the greatest uptake occurred between 60 and 88 DAS. The decrease in the uptake at the end of the cycle of cultivars may have been caused by the redistribution of nutrients to the reproductive organs (COUCH et al., 2017). In the fruits, nitrogen uptake was increased up to 105 DAS, and the CNPA G4 obtained higher uptake for both cultivation periods, 1.09 g plant^{-1} (Growing Season I) and 1.30 g plant^{-1} (Growing Season II) (Figure 2E and 2F).

Corrêa et al. (1995), in studying sesame, found that the maximum nutrient uptake occurs at 86 days after plant emergence. Santos et al. (1982), studying cultivation of sesame in Venezuela, found nitrogen uptake in the vegetative part of 2.45 g plant^{-1} and for the fruit 1.93 g plant^{-1}. Shilpi et al. (2014), when evaluating sesame culture in Bangladesh, found a maximum uptake of 3.47 g plant^{-1}.

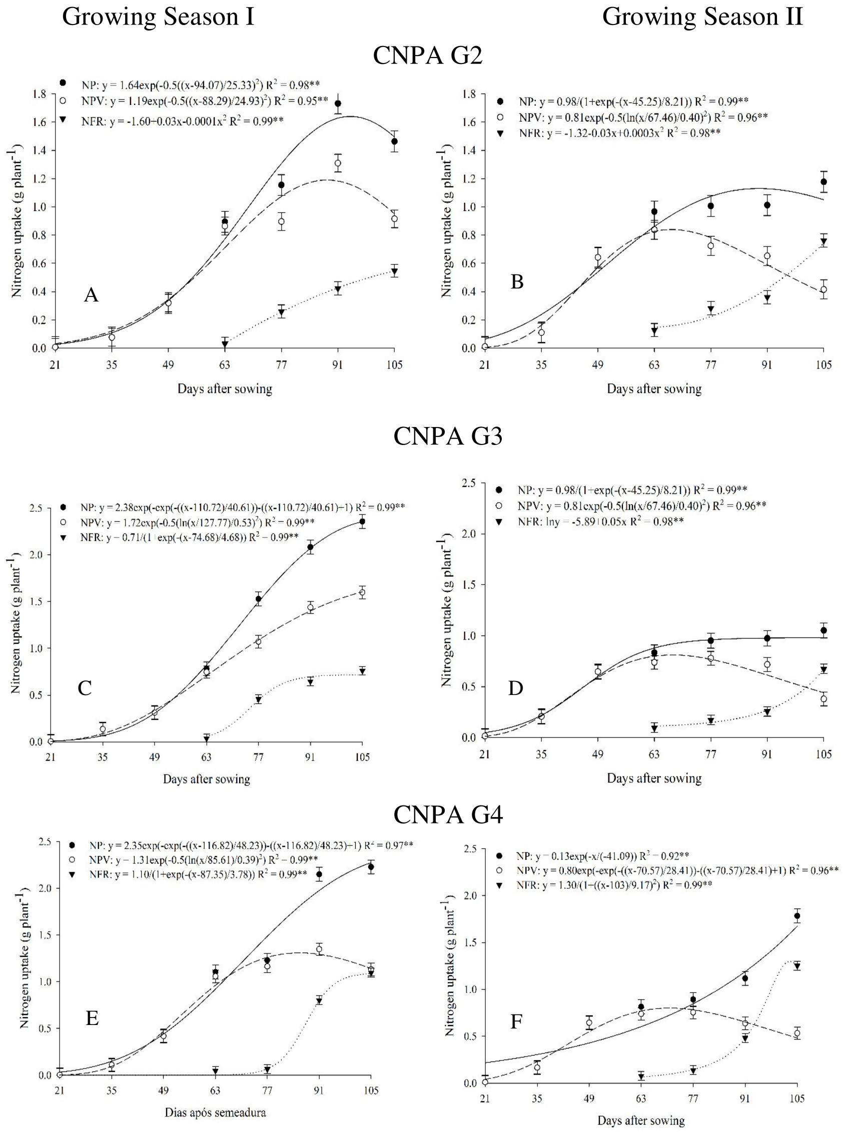

Figure 2. Uptake of nitrogen in relation to the harvesting dates of cultivars CNPA G2 in Growing Season I (A) and Growing Season II (B); CNPA G3 at Growing Season I (C) and Growing Season II (D); and CNA G4 at Growing Season I (E) and Growing Season II (F). NP: nitrogen in the plant; NPV: nitrogen in the vegetative part; NFR: nitrogen in fruits.

In relation to the cultivation season, greater accumulations were observed in the crop from November 2014 to February 2015 with an average rainfall of 3.56 mm in month^{-1}, while in the season from April to July of 2015 the precipitation was 24 mm month^{-1}, and may have caused leaching of the nutrient in the soil.

Nitrogen is the most limiting nutrient production and is responsible for various functions of metabolism in plant nutrition and is extracted in large quantities, which is why sesame is regarded as exhausting the soil. Nitrogen deficiency can cause nutritional disorder and decreased production, while its excess causes increased incidence of pests and diseases, reduced production, and reduced oil content (BISCARO et al., 2008; WU et al., 2009).

Phosphorus uptake in intensified plant itself to from 49 DAS. In Growing Season I, were estimated maximum from 0.16 g $plant^{-1}$ (CNPA G2) at 88 DAS; 0.18 g $plant^{-1}$ (CNPA G3) and 0.17 g $plant^{-1}$ (CNPA G4), both at 105 DAS (Figure 3A, 3C and 3E). In Growing Season II, 0.29 g $plant^{-1}$ (CNPA G2); 0.34 g $plant^{-1}$ (CNPA G3), and 0.41 g $plant^{-1}$ (CNPA G4), both at 105 DAS (Figure 3B, 3D and 3F). The sesame culture absorbs phosphorus in minor amounts up to 30 days after planting, the increases later with maximum demand ing between 60 and 90 days (ARRIEL et al., 2007). Similar results were verified by Santos et al. (1982) and Laviola and Dias (2008), demonstrating the need to match the end of the cycle.

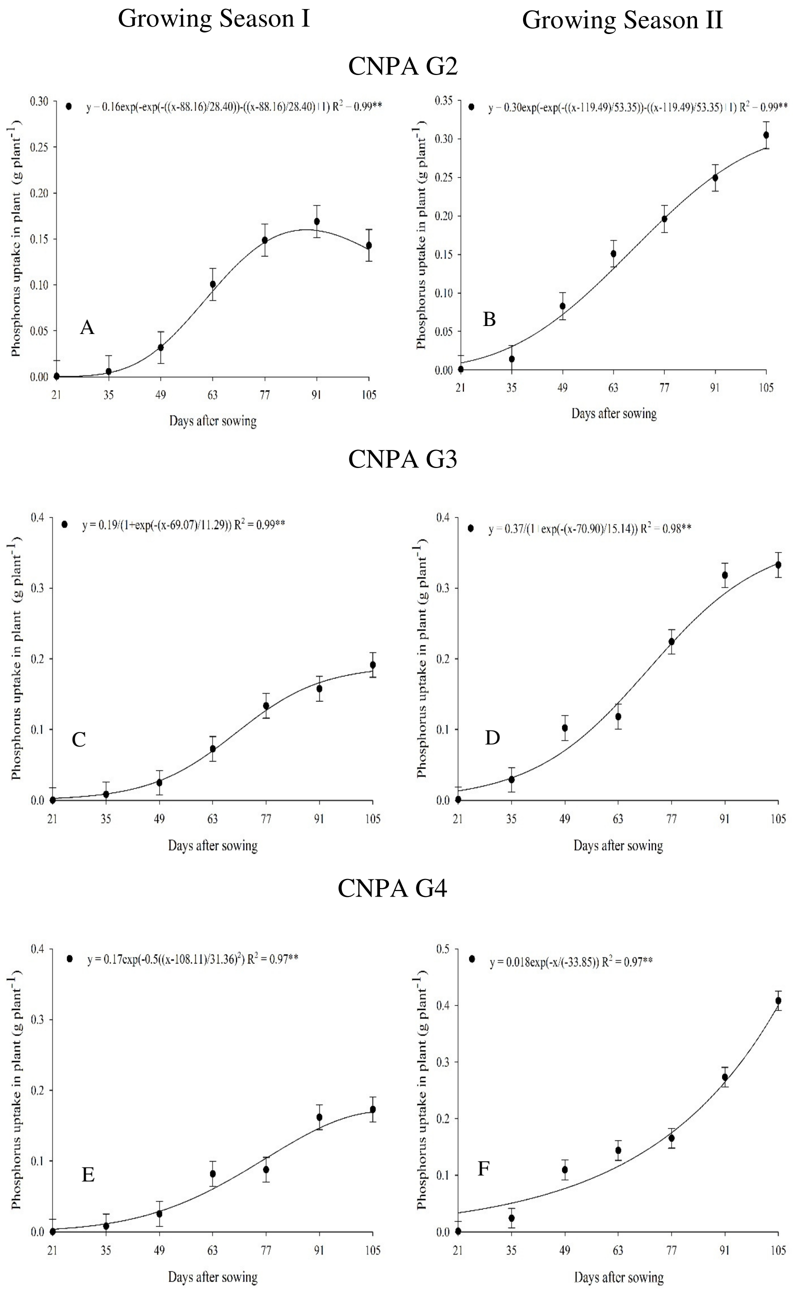

Figure 3. Phosphorus uptake in the plant in relation to the harvesting dates of cultivars CNPA G2 in Growing Season I (A) and Growing Season II (B); CNPA G3 in Growing Season I (C) and Growing Season II (D); CNA G4 in Growing Season I (E) and Growing Season II (F).

Significant differences occurred among cultivars, at 63 DAS in Growing Season I, and 35 DAS in Growing Season II. CNPA G3 (Season I) and CNPA G4 (Season II) had the maximum uptakes, at 105 DAS. The maximum phosphorus demand occurred between 63 and 91 DAS, Growing Season I, while in Growing Season II, it lasted until 105 DAS.

For phosphorus uptake in vegetative parts and fruits, the assumptions of the pooled analysis were not answered, and we discussed the times individually.

The phosphorus uptake in the vegetative part of Growing Season I was slow at the beginning of development, intensifying to 49 DAS, with maximum values 0.13 g $plant^{-1}$ after 84 DAS (CNPA G2); 0.14 g $plant^{-1}$ at 105 DAS (CNPA G3); and 0.13 g $plant^{-1}$ at 105 DAS (CNPA G4) (Figure 4A). The maximum phosphorus uptake in fruits occurred at 105 DAS in CNPA G2 (0.04 g $plant^{-1}$) and CNPA G3 (0.05 g $plant^{-1}$) and at 99 DAS in CNPA G4 (0.05 g $plant^{-1}$) (Figure 4B).

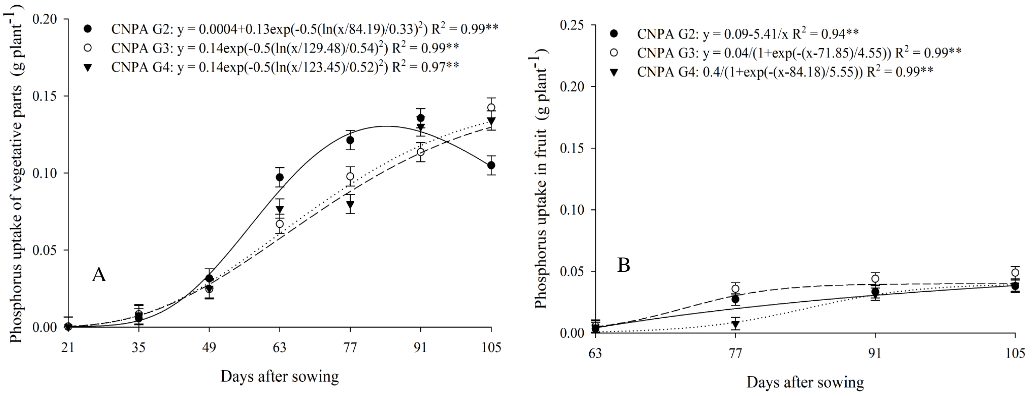

Figure 4. Phosphorus uptake of vegetative parts (A) and fruits (B) in relation to the harvesting dates of sesame cultivars at Season I.

In Growing Season II, maximum phosphorus uptake in the vegetative parts was at 88 DAS in CNPA G2 (0.14 g $plant^{-1}$), and at 105 DAS in CNPA G3 (0.19 g $plant^{-1}$) and CNPA G4 (0.18 g $plant^{-1}$) (Figure 5A). In fruits, phosphorus uptake was increased to 105 DAS, maximum 0.16 (CNPA G2); 0.15 (CNPA G3); and 0.22 g $plant^{-1}$ (CNPA G4) (Figure 5B).

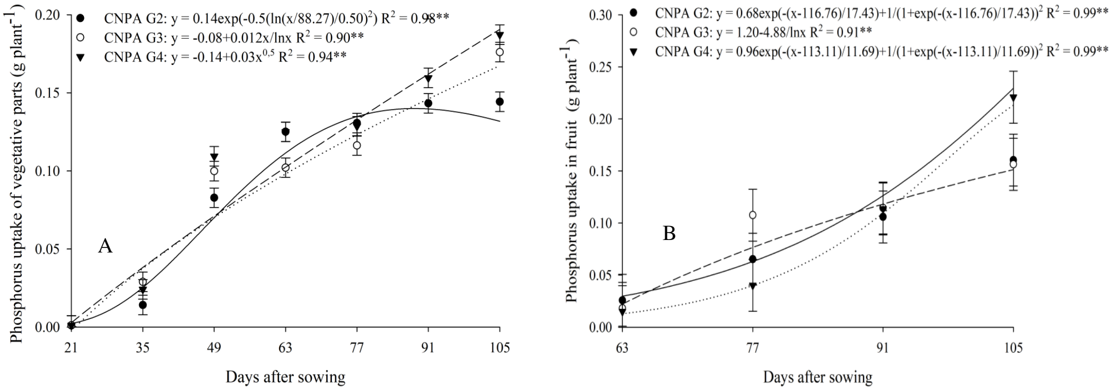

Figure 5. Phosphorus uptake of vegetative parts (A) and fruit (B) in relation to the harvesting dates of sesame cultivars in Season II.

The accumulation of potassium in the plant was intensified from 35 DAS, with maximum estimated 1.97 g $plant^{-1}$ at 79 DAS (CNPA G2); 2.27 g $plant^{-1}$ at 105 DAS (CNPA G3); 2.02 g $plant^{-1}$ at 87 DAS (CNPA G4) in Growing Season I (Figure 6A, 6C and 6E). Growing Season II, 0.98 g $plant^{-1}$ at 81 DAS (CNPA G2); 0.82 g $plant^{-1}$ after 87 DAS (CNPA G3); and 1.17 g $plant^{-1}$ at 105 DAS (CNPA G4) (Figure 6B, 6D and 6F).

In the vegetative part of the plant, the estimated maximum uptake in Growing Season I, 1.81 g $plant^{-1}$ (CNPA G2) at 76 DAS; 1.90 g $plant^{-1}$ (CNPA G3) to 100 DAS and 1.75 g $plant^{-1}$ after 82 DAS (C NPA G4) (Figure 6A, 6C and 6E). In Growing Season II, the estimated maximum uptake was 0.85 g plant^{-1} (CNPA G2) at 76 DAS; 0.62 g plant^{-1} (CNPA G3) at 81 DAS; and 0.73 g plant^{-1} (CNPA G4) at 94 DAS (Figure 6B, 6D and 6F).

There was a significant difference between cultivars with respect to potassium and uptake in plant vegetative part was observed from 49 DAS in Growing Season I, with the maximum at 105 DAS in CNPA G3, while for Growing Season II, it took place from 63 DAS with maximum uptake to 105 DAS in CNPA G4. Potassium uptake in the fruits was increased up to 105 DAS, where CNPA obtained G4 higher uptake in the two periods of cultivation, 0.54 (Growing Season I) and 0.50 (Growing Season II) g plant^{-1} (Figure 6E and 6F). The demand in the fruit potassium possibly caused a decrease in the uptake of the vegetative part at the end of the cycle due to the increased need for fruit nutrients development.

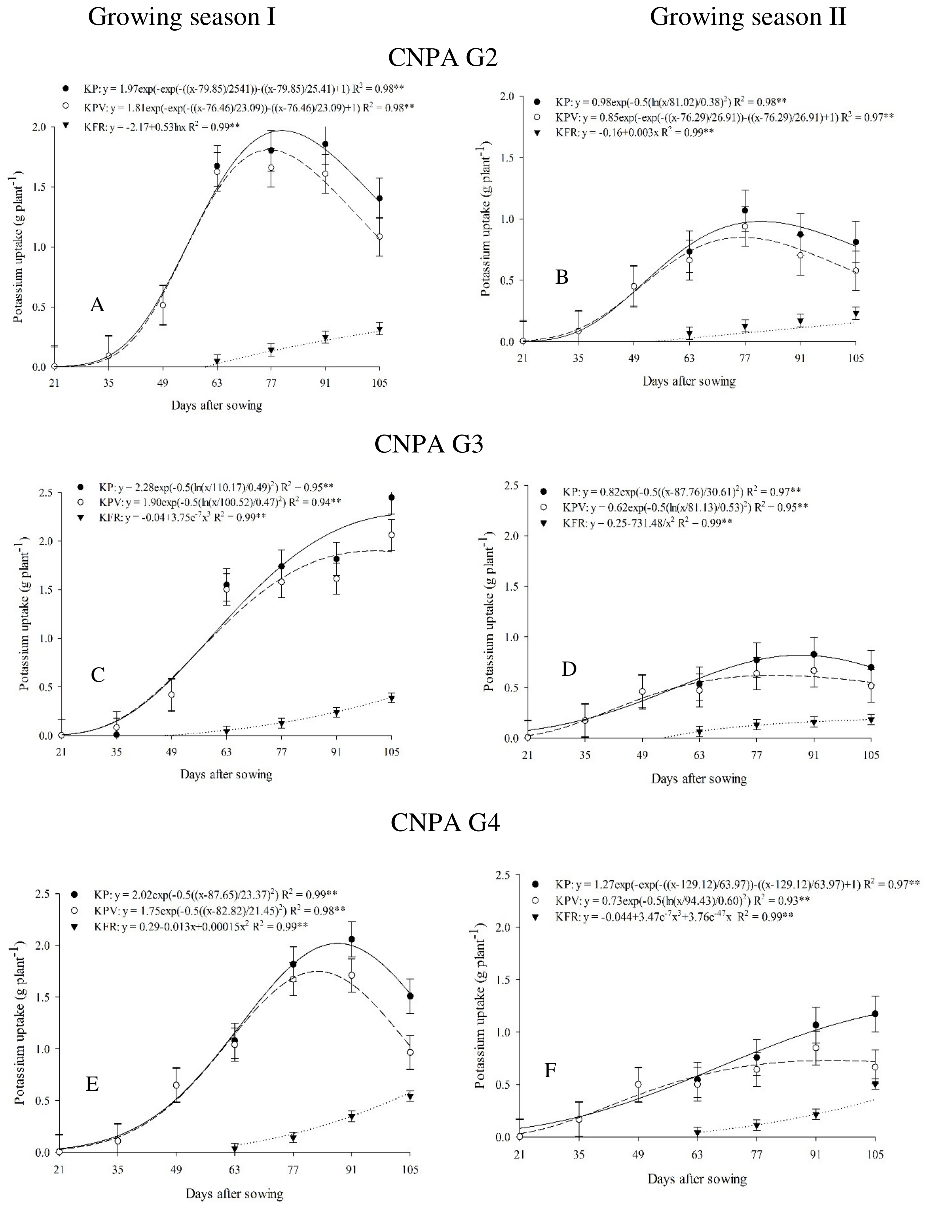

Figure 6. Potassium uptake in relation to harvesting dates of cultivars CNPA G2 in Growing Season I (A) and Growing Season II (B); CNPA G3 in Growing Season I (C) and Growing Season II (D); CNA G4 in Growing Season I (E) and Growing Season II (F). KP: Potassium in the plant; KPV: Potassium in the vegetative parts; KFR: Potassium in fruits.

Potassium plays a key role in the growth, conformation, and quality of the fruit. Thus, to obtain greater productivity, it is necessary that the soil have adequate quantities and be available to provide a suitable supply to the plant, confirming an uptake of this nutrient by the end of the cycle (ALBUQUERQUE et al., 2011). According Arriel et al. (2007), potassium is the most required nutrient of the crop, which absorbs little of this nutrient until 30 days after planting, but from 35 days the demand of the plant grows dramatically and keeps growing until the end of the cycle.

The productivity obtained for CNPA G2, CNPA G3, and CNPA G4, respectively, was 867, 951 and 1375 kg ha^{-1} in Growing Season I, and 875, 740 and 915 kg ha^{-1} in Growing Season II. Given a population of 111,111 plants ha^{-1}, for the productivities presented by the same, the nutrient extraction at the end of the cultivation cycle was: for CNPA G2: 162.54 kg ha^{-1} N, 15.89 kg ha^{-1} P, and 156.03 kg ha^{-1} K in Growing Season I, and 130.70 kg ha^{-1} N, 33.87 kg ha^{-1} P, and 90.16 kg ha^{-1} K in Growing Season II; for CNPA G3: 261.96 kg ha^{-1} N, 21.26 kg ha^{-1} P, and 272.14 kg ha^{-1} K in Growing Season I, and 116.72 kg ha^{-1} N, 36.96 kg ha^{-1} P, and 77.64 kg ha^{-1} K in Growing Season II; and for CNPA G4: 247.67 kg ha^{-1} N, 19,21 kg ha^{-1} P, and 167,70 kg ha^{-1} K in Growing Season I, and 198.23 kg ha^{-1} N, 45.36 kg ha^{-1} P, and 130.50 kg ha^{-1} K in Growing Season II.

CONCLUSIONS

The vegetative part of the sesame crop had greater uptake of potassium in Growing Season I (the period from November 2014 to February 2015) and of nitrogen in Growing Season II (the period from April to July 2015) for all the cultivars, whereas in the fruits the greatest uptake was that of nitrogen, independent of growing season.

As for the total uptake of nutrients at the end of the cycle, it followed the descending order N > K > P in both growing seasons.

The period of greatest demand for nutrients occurred between 77 and 105 DAS. In relation to the cultivars, the CNPA G3 obtained larger uptakes in Growing Season I (the period from November 2014 to February 2015), while the CNPA G4 did so in Growing Season II (the period from April to July 2015).

ACKNOWLEDGEMENTS

Special thank to the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), for the financial support to this research.

RESUMO: O gergelim é considerado a semente oleaginosa mais antiga em uso pela humanidade. É uma cultura de alta complexidade morfofisiológica com grande variabilidade no hábito de crescimento. O acúmulo de nutrientes na cultura do gergelim é, em termos relativos, proporcional a sua produtividade média. É uma cultura que necessita da disponibilidade de quantidades suficientes de nitrogênio, fósforo e potássio para obtenção de uma produtividade desejada. Dessa forma, o objetivo deste trabalho foi avaliar o acúmulo de nutrientes por cultivares de gergelim, em duas épocas de cultivo em condições semáridas. Os experimentos foram realizados na Horta Didática da Universidade Federal Rural do Semi-Árido, no período de novembro de 2014 a fevereiro de 2015 (Época de cultivo I) e de abril a julho de 2015 (Época de cultivo II). O delineamento experimental utilizado foi em blocos casualizados completos, com quatro repetições. Os tratamentos foram dispostos em parcelas subdivididas onde as cultivares (CNPA G2, CNPA G3 e CNPA G4) ocuparam as parcelas e as épocas de coletas (21, 35, 49, 63, 77, 91 e 105 dias após a semeadura) as subparcelas. A parte vegetativa da cultura do gergelim teve maior acúmulo de potássio na época de cultivo I (período de novembro de 2014 a fevereiro de 2015) e de nitrogênio na época de cultivo II (período de abril a julho de 2015) para todas as cultivares. Em relação aos frutos a maior acúmulo foi de nitrogênio, independente da época de cultivo. Quanto ao acúmulo total de nutrientes ao final do ciclo, seguiu a ordem decrescente N> K> P em ambas as épocas de cultivo. O período de maior demanda por nutrientes ocorreu entre 77 e 105 DAS. Em relação às cultivares, o CNPA G3 obteve maiores acúmulos na época de cultivo I (período de novembro de 2014 a fevereiro de 2015), enquanto o CNPA G4 o fez na época de cultivo II (período de novembro de 2014 a fevereiro de 2015).

PALAVRAS-CHAVE: *Sesamum indicum*. Macronutrientes. Época de coleta.

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