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Effect of Acid Acetylsalicylic on Agronomic and Nutritional Responses of Forages

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Abstract

To determine the effect of acetylsalicylic acid (SA) on the productive behavior of three forage species. Three levels of acetylsalicylic acid 0, 1, 1. 5 L. ha^{-1} at three cutting intervals 25, 35, 45 days; under a bifactorial completely randomized block design (3X3) with three replications were applicated. The results indicate that treatment 1.5 L. ha^{-1} SA with 45 days showed a positive effect on the agronomic variables: plant height, number of stems, plant vigor, green and dry matter yield per hectare in most forage species. The nutritive value analysis carried out on each forage species indicated that the 1 L ha^{-1} SA with 35 days presented the best values for ash content, ethereal extract, protein, and free nitrogen extract. Consequently, it is recommended to apply the 1.5 L. ha^{-1} SA with 45 days on forage species grown in monoculture, since they showed the best results in the agronomic variables analysed in this study.

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INTRODUCTION

Plants as sedentary organisms cannot escape from attackers and stressors and have to adjust to surrounding environment and biotic attacks through their life cycle. Therefore, plants are subjected to a wide range of environmental stresses which reduces and limits the productivity of agricultural crops. Biotic stresses are considered one of the greatest barriers to the growth and development of plants, representing one of the most worrying abiotic stresses for the scientific community. Stresses trigger a wide range of plant responses like altered gene expression, cellular metabolism, changes in growth rates. Also, plant stresses are divided in two categories namely abiotic and biotic stresses. Abiotic stress imposed on plants by environment may be either physical or chemical. Whereas abiotic stresses can be due to exposition to biological unit as diseases, insects, etc. In this sense, studies on the use of exogenously applied compounds as a tolerance strategy against the effects of many abiotic stresses have become relevant. In fact, plant hormone antioxidants, signaling molecules, polyamines (PAs), and trace elements, among others, are being widely used for mitigating damage in plants (Hasanuzzaman et al. 2003). In the same line, scientific evidence has showed that salicylic acid (SA) is responsible for metabolic pathways that are interconnected with others involved in the formation of various relevant signaling molecules and metabolites in plants under stress responses. Besides this, SA which belongs to a very diverse group of substances known as phenolic compounds, it participates in many metabolic functions in plants, such as lignin synthesis, allelopathic activity and in some cases in the biosynthesis of phytoalexins (Sanchez et al., 2011). Consequently, the growth promoters have proved to be a practice of great productive impact in crops, giving higher yields in green matter, dry matter and nutritive value, representing a very interesting tool in unfavourable environments (Morón, 2008).

In effect, several studies have been performed in they are seen that plant growth regulators such as SA has positive effect in increasing the growth and yield (Khan et al., 2006). In addition, Coronado et al. (1998) showed that SA increased the number of flowers, pods per plant and grain yield of soybean. Therefore, SA positive role on physiological processes such as cell division, plant growth and the biosynthesis of cell wall and increased the synthesis of many pigments like carotenoid and xanthophylls.

In recent years, Ecuadorian livestock has grown significantly, in cattle population both destined for meat and milk; the country has 4.13 million head being the province of Pichincha the largest producer of milk with 15, 90% of the national total (INEC, 2018). However, the

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livestock sector has difficulties in maintaining a constant and sustained development due to the poor and scarce feed provided to cattle, even though our country has favourable conditions to produce pasture all year round (León, 2003). For this reason, the use of growth promoters could provide practice best of great productive impact in pastures, giving higher yields in green matter, dry matter and nutritive value, representing a very interesting tool in unfavourable environments (Morón, 2008). In Ecuadorian conditions, limited studies in forages have been performed. Therefore, the objective of this study was to evaluate the effect different levels of acetylsalicylic acid in forages destinated for ruminant nutrition.

Materials and methods

Study area

This study was carried out in town of Cutuglagua, canton Mejía, province of Pichincha, Latitude: 00°22'00" S, Longitude: 78° 33'00"W and ltitude: 3058 m.a.s.l. Cutuglagua is in the Cold Montane Rainforest life zone, with an average annual temperature of 11.6°C, rainfall of 1400 mm/year and an average relative humidity of 79%.

Experimental conditions

Seventy-six experimental plots were delimited with the following dimensions: 3 m wide by 5 m long, each plot being 15 m2 and for each cutting interval an area of 5 m2 was used. Then, three forage species annual rye grass (*Lolium rigidum*), blue grass (*Poa pratensis*) and fodder plantain (*Plantago lanceolata*) were sown according to manufacture recommendations (60 g of seed for each plot).

Experimental treatments

After 90 days from planting, all plots were cut to promote uniform growth. Thereafter, the experiment was arranged under a completely randomized block design with a bifactorial arrangement (3 × 3) with three replicates for each species under study. Therefore, the treatments were a combination of three dose of SA (0, 1 and 1.5) and three grazing frequencies (GF, 25, 35 and 45 days), as follow:

T1, *Lolium rigidum* = 0 + *25* GF
T2, *Lolium rigidum* = *1* litre+ *35* GF
T3, *Lolium rigidum* = 1.5 litre + 45 GF
T4, *Poa pratensis* = 0 + *25* GF
T5, *Poa pratensis* = 1 litre + 35 GF
T6, *Poa pratensis* = 1.5 litre + 45 GF
T7, *Plantago lanceolata* = 0 + *25* GF
T8, *Plantago lanceolata* = 1 litter + 35 GF
T9, *Plantago lanceolata* = 1.5 litre + 45 GF

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Measurement data

Canopy height

The height was taken from the base of the plant to the apex of the flag leaf with a tape measure, the variable was measured every 10 days until cutting, for which, from each net plot of each treatment, 10 plants were taken to determine their height and average recorded in cm, in the field book.

Plant vigour

Characteristics such as stem thickness and number of tillers of each plant were identified visually.

Number of stems per plant

A sample of 10 plants was taken from each net plot, from each treatment to count the number of stems per plant, this variable was measured only once before each cutting.

Forage dry matter production

For the dry matter, a sub-sample (200 g) was taken, which were sheathed, labeled and placed in the oven, where they were dried for 24 hours at 100°C. The samples were then weighed and the dry matter percentage and dry matter yield in kg DM ha^{-1} of each treatment were determined by weight differences.

Chemical composition

The sampling technique as an initial part of an integral study of forages was done respecting the criteria of uniformity and representativeness. For this reason, a 1 kg sample was taken from each treatment. Once the samples were collected in the field, they were analysed according to AOAC (2000).

Results and Discussion

The Tukey test at 5% established that the plants that received the d3 dose (1.5 L. ha^{-1} SA) presented a greater height with 27.27 cm, the lowest height was with the dose of (1 L. ha^{-1} SA) with 24.01 cm. Plants cut at 45 days obtained the best response with 28.31 cm, while plants cut at c1 obtained a height of 24.21 cm (Table 1).

Table 1. Tukey's test at 5% for agronomical variables

Item		Canopy height	Stems per plant	Plant vigor	Dry matter(kg MS. ha^{-1})
Dose (SA)					
0	L. ha^{-1}	24.01^{b}	11.11^{b}	2.44^{b}	1600.09^{b}
1 L	L. ha^{-1}	26.38^{ab}	14.44^{ab}	$2.78a^{b}$	1886.47^{a}
1.5 L	L. ha^{-1}	27.27^{a}	17.00^{a}	3.33^{a}	1922.73^{a}
Cut					

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25	25 días	24.21[b]	16.22[a]	2.56	1469.74[b]
35	35 días	25.14[b]	15.33[a]	3.00	1957.90[a]
45	45 días	28.31[a]	11.00[b]	3.00	1981.66[a]
Treatment					
Lolium rigidum	T1	21.14[c]	12.67	2.67	1274.23
Poa pratensis	T2	24.61[abc]	11.00	2.33	1836.03
Plantago lanceolata	T3	26.32[abc]	9.67	2.33	1690.00

[a-b] Means con different words in the same line differ a $P > 0.05$

In the interaction Dose (SA) x days of cutting, Table 1, three ranges were established, with the best response to treatment T3 (1.5 L. ha^{-1} SA with 45 days) in first place with 26.3 cm, followed by T2 (1 L. ha^{-1} SA with 45 days) with 24.6 cm and in last place T1 with 21.14 cm. These results coincide with those described by González et al., (2015), who mention that in their study when applying concentrations of 1.5 ml/L of acetylsalicylic acid, rice plants var. J-104 presented a considerable increase in plant height compared to control plants.

Tukey's test at 5%, Table 1, establishes that the plants that received a dose (1.5 L. ha^{-1} SA) obtained the best response with 17 stems/plant, while the 0 dose (without product) obtained 11.11 stems/plant. Plants cut at 25 days showed a higher number of stems with 16.22 stems/plant, the lowest number was in plants cut at 45 days with 11 stems/plant.

Studies by Morales et al. (2013), indicate that the number of flowers per plant increased by 56% when salicylic acid was administered to Gerbera jamesonii flowers at the first cutting, while in this research the number of stems per plant increased by 64% at the first cutting, increasing green matter production.

The 5% Tukey test, Table 1, establishes that the plants that received the dose of (1.5 L. ha^{-1} SA) obtained the best vigor with 3.33 (good), the lowest vigor was obtained with the 0 dose (without product) with a vigor of 2.44 (fair).

The results obtained in this study corroborate with those reported by González et al. (2015), who obtained an increase in the vigor of rice plants var. J-104 when applying concentrations of 1.5 ml/L of acetylsalicylic acid. concentrations of 1.5 ml/L of acetylsalicylic acid, by improving vigor the plants presented a greater defense against diseases and pests of this crop.

Tukey's test at 5%, establishes that when applying a dose (1.5 L. ha^{-1} SA) the highest yield was obtained with 1922.73 Kg Ms. ha^{-1}, the lowest yield was obtained when applying a 0 dose (without product) with 1600.00 Kg Ms. ha^{-1}. Plants that were cut at 45 days have the highest yield with 1981.66 Kg DM ha^{-1}, the lowest yield was in plants cut at 25 days with 1469.74 Kg DM ha^{-1} (Table 1).

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Vargas et al., (2018), indicates that the dry matter yield of perennial Rye grass with an initial fertilization varies according to the number of cutting obtaining values between 440; 890; 221.0 kg DM. ha^{-1} in the first, second and third evaluation cut; while in this study with the application of acetylsalicylic acid the yields increased between values of 1469.74; 1957.90; 1981.66 kg DM ha^{-1} in each cutting interval.

Table 2. Chemical composition

	Chemical composition				
Treatment	**Humidity**	**Ash**	**E.E**	**Protein**	**fibre**
Lolium rigidum	82.22	11.88	3.65	18.05	24.42
Poa pratensis	71.01	11.03	3.55	15.59	25.30
Plantago lanceolata	74.00	11.34	4.63	13.72	23.80

The treatment that obtained the lowest moisture content was *Lolium rigidum* with 82.22%, for ash and ethereal extract the best treatment was *Plantago lanceolata* with 11.34% and 4.36%, respectively. Whereas *Lolium rigidum* had greater crude protein contents than other forages (18 vs 14%).

According to Verdecia et al. (2019), the reduction of degradability is influenced by the increase of the age of the plant which leads to a thickening of the cell wall and thus reduces the intracellular space where nutrients are found, this coincides with the results obtained in fiber content where the lower content causes a low digestibility while plants with a high fiber content do not have a good digestibility.

Conclusion

Bases to our results, plants cut at 45 days showed the best agronomic response for plant height, number of stems, plant vigor, green and dry matter yield per hectare for most forage species, while plants cut at 25 days showed no significant differences. Therefore, it is recommended to apply the 1.5 L. ha^{-1} SA with 45 days) on forage species grown in monoculture, since they showed the best results in the agronomic variables analysed in this study.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCES

Sanchez, D. H., Pieckenstain, F. L., Escaray, F., Erban, A., Kraemer, U. T. E., Udvardi, M. K., & Kopka, J. (2011). Comparative ionomics and metabolomics in extremophile and glycophytic Lotus species under salt stress challenge the metabolic pre-adaptation hypothesis. Plant, Cell & Environment, 34(4), 605-617.

González, T., López, Y., & Isora, F. (2015). Effect of acetylsalicylic acid on germination and growth of Rice Seedling (Oryza sativa L.). Rice Research Institute, 8. Retrieved from http://www.actaf.co.cu/revistas/.

Khan, Z. I., Hussain, A., Ashraf, M., & McDowell, L. R. (2006). Mineral status of soils and forages in Southwestern Punjab-Pakistan: Micro-minerals. Asian-australasian journal of animal sciences, 19(8), 1139-1147.

ISSN: 1533 – 9211

León-Velarde, C. U., & Quiroz, R. (2003). The development of livestock production systems in the Andean region: implications for smallholder producers. Animal production and animal science worldwide: A Review on Developments and Research in Livestock Systems, World Association of Animal Production, Book of the Year, 233-240.

Morales, E., Morales, J., Mora, O., Pérez, D., González, A., & Urbina, E. (2013). Flower production of Gerbera jamesonii cv. Dream as a function of gibberellic and salicylic acids. Scielo Journal, 7. Retrieved from http://www.scielo.org.ar/scielo.php?pid=S185156572014000200015&script=sci_arttext&tlng=en.

Morillo Coronado, A.C., Muñoz Flórez, J. E., & Morillo Coronado, Y. (2008). Microsatélites amplificados al azar (RAM) en estudios de diversidad genética vegetal. Acta agronómica, 57(4), 219-226.

Moroń, D., Witek, M., & Woyciechowski, M. (2008). Division of labour among workers with different life expectancy in the ant Myrmica scabrinodis. Animal Behaviour, 75(2), 345-350.

Official methods of analysis of AOAC International. Volume I, agricultural chemicals, contaminants, drugs/edited by William Horwitz. Gaithersburg (Maryland): AOAC International, 2000.

Peña, A., & Pinta, F. (2012). Análisis sectorial. Pichincha, Guayas, Tungurahua se asientan el mayor número de establecimientos del sector textil. Dirección de Estadísticas y Economía INEC.

Vargas, C., Sanchéz, T., Janeta, N., & Sanchéz, R. (2018). Evaluación de Diferentes Dosis de Enmiendas Húmicas en la producción primaria de Forraje del Lolium perenne. Escuela Politécnica de Chimborazo, Riobamba - Ecuador.

Verdecia, D. M., Santana, A. A., Cheng, L., Ramírez, J. L., López, S., Cisneros, M. V. & Al-Marashdeh, O. (2019). Effect of a mixed silage of king grass (Cenchrus purpureus) and forage legumes (Leucaena leucocephala or Gliricidia sepium) on sheep intake, digestibility and nitrogen balance. Animal Production Science, 59(12), 2259-2264.