Nota Científica/Short Communication

Protein hydrolysate formulations on vase life for cut roses

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Abstract

This study investigated the effects of commercial protein hydrolysate formulations applied by different methods for improving cut rose quality and vase life. The experiment was performed on plants of Cardinal roses. Four commercial products [Agrostim®, TerraSorb® (foliar), TerraSorb® (substrate) and AminoQuelant®)] containing amino acids and low molecular weight peptides were used. A generalized increase in dry weight of flowering shoots was observed when products were applied for a relatively long time (5 months at a weekly frequency). A correlated increase in vase life was also found. The response was independent of the application method.

Additional key words: rose; postharvest; cut flower; amino acids; peptides

Resumo

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Este estudo investiga os efeitos de formulações comerciais de proteína hidrolisada aplicadas por diferentes métodos na melhoria da qualidade e na duração em vasos de hastes de rosa cortadas. O experimento foi desenvolvido com plantas de roseira Cardinal. Foram usados quatro produtos comercias [Agrostim®, TerraSorb® (foliar), TerraSorb® (substrato) e AminoQuelant®] contendo aminoácidos e peptídeos de baixo peso molecular. Aumento generalizado na acumulação de massa seca nas hastes de rosa foi observado quando os produtos foram aplicados por um tempo relativamente longo (5 meses com freqüência semanal). Foi também observado aumento correlato na duração em vaso das hastes de rosa cortadas. A resposta foi independente do método de aplicação.

Palavras-chave adicionais: rosa; pós-colheita; flor de corte; aminoácidos; peptídeos.

Introdução

Greenhouse roses flower periodically throughout the year. After a flower shoot is harvested, a new shoot develops from the uppermost axillary bud and normally reaches commercial maturity in 5-8 weeks. Rose plants tend to undergo flushes of growth and flowering. These growth flushes may cause periods of high and low plant demand for mineral nutrients.

Free amino acids and peptides of very low molecular weight can be easily absorbed by plant roots (SCHOBERT et al., 1988) and transported to other organs (KATO et al., 1985). Previous reports suggest that combining amino acids with mineral elements improves the permeability of cell membranes to nutrients (SHADDAD, 1990), thereby increasing the efficiency of fertilization. Some authors have observed the formation of chelates, which were translocated throughout the vascular system (MULLINS et al., 1986).

Products containing amino acids and low molecular weight peptides are used to complement fertilization with mineral elements (FRANCO et al., 1994). Protein hydrolysates are obtained by the hydrolysis of protein to amino acids and peptides. However, there is no research so far on roses to support their use.

In organic production systems, nutrients are supplied by crop residues, cover or green manure crops, animal manures, compost and mined limestone. Nutrient availability in organic crops is limited by the time taken for complex organic mater to decompose. During the past two decades there has been a marked increase in

the utilization of commercial protein hydrolysates as an alternative to conventional synthetic fertilizers. However, the precise mechanism by which they elicit their beneficial growth responses is still not fully understood (FRANCO et al., 1994).

Since the floriculturist returns are also related to flower quality, post-harvest behavior is becoming a growingly important aspect in ornamental plant production. Strong market competition means that high product quality is necessary for economic success. Products produced worldwide may be stored or transported for long periods, potentially decreasing quality and impairing post-harvest life.

This study investigates the effects of commercial protein hydrolysate formulations and application methods on post-harvest rose vase life.

Materials and methods

Rose plants were grown from middle-spring to end-summer at greenhouse commercial facilities from Buenos Aires, Argentina (34° 28' S). Experiment was performed on four year-old Cardinal (red) plants grown in greenhouse soil. The following treatments were applied weekly at the recommended label rate during the spring-summer production cycle of 5 months to 60 plants each: Control with no added formulates; Agrostim® (A_L) as a foliar spray at 1.0 ml l^{-1}, TerraSorb® (T_L) as a foliar spray at 3.0 ml l^{-1}; AminoQuelant® (AQ_L) as a foliar spray at 1.5 ml l^{-1}; AminoQuelant® (AQ_S) as a substrate application at 0.5 ml m^{-2}; AminoQuelant® + Agrostim® (AQ_S-A_L) as a substrate application of AminoQuelant® (0.5 ml m^{-2}) plus a foliar spray of Agrostim® (1.0 ml l^{-1}); AminoQuelant® + TerraSorb® (AQ_S-T_L) as a substrate application of AminoQuelant® (0.5 ml m^{-2}) plus a foliar spray of TerraSorb® (3.0 ml l^{-1}); AminoQuelant® + AminoQuelant® (AQ_S-AQ_L) as a substrate application of AminoQuelant® (0.5 ml m^{-2}) plus a foliar spray of AminoQuelant® (1.5 ml l^{-1}); TerraSorb® (T_S) as a substrate application at 1.0 ml m^{-2}; TerraSorb® + Agrostim® (T_S-A_L) as a substrate application of TerraSorb® (1.0 ml m^{-2}) plus a foliar spray of Agrostim® (1.0 ml l^{-1}); TerraSorb® + TerraSorb® (T_S-T_L) as a substrate application of TerraSorb® (1.0 ml m^{-2}) plus a foliar spray of TerraSorb® (3.0 ml l^{-1}) and, TerraSorb® + AminoQuelant® (T_S-AQ_L) as a substrate application of TerraSorb® (1.0 ml m^{-2}) plus a foliar spray of AminoQuelant® (1.5 ml l^{-1}).

Plants were grown under commercial management with weekly soil fertilization of 250 ppm N (1N:0.4P:0.8K). Chemical composition of the four commercial formulates Agrostim® , TerraSorb® (foliar); TerraSorb® (substrate) and AminoQuelant® are reported in Table 1.

TABLE 1 - Chemical composition of the commercial protein hydrolysate formulations used for roses.

AGROSTIM®		TERRA-SORB® (Leaf)		TERRA-SORB® (Substrate)		AMINOQUELANT-Ca®	
		Free aminoacids		Free aminoacids	9.34 %		
		Total aminoacids	4.0 %	Total aminoacids	12.06 %		
		N	6.0 %	N	2.13 %		
		P	3.0 %	P	0.19 %		
		K	1.0 %	K	0.064 %		
		Organic matter	2.0 %	Organic matter	14.87 %	Free aminoacids	4.58 %
L-Cysteine	98.0 %	Cd	7.0 %	B	0.019 %	N	4.89 %
Folic acid	2.0 %	Ni	0.03 g L^{-1}	Mn	0.046 %	Ca	8.00 %
		Pb	0.35 g L^{-1}	Cd	0.03 g L^{-1}	B	0.20 %
		Cr	1.00 g L^{-1}	Ni	0.35 g L^{-1}		
		Zn	0.75 g L^{-1}	Pb	1.00 g L^{-1}		
		Co	3.00 g L^{-1}	Cr	0.75 g L^{-1}		
			1.50 g L^{-1}	Zn	3.00 g L^{-1}		
				Co	1.50 g L^{-1}		

Thirty rose stems of each treatment were harvested at the commercial stage and then dried at 80 °C for 48 hours and weighed.

Pre-harvest treatment effects on cut rose post-harvest performance was evaluated after overnight wet storage in water at around 3 °C following by recutting, and defoliated along the lower 20 cm of the stem. Ten stems per treatment were placed individually into glass tubes (length x diameter = 19.8 x 3.2 cm) containing tap water. The glass tubes were kept in racks placed in a controlled environment room (20 °C air temperature, 60-65% relative humidity, 12-h photoperiod, photosynthetic photon flux density at bud level of 30 µmol m^{-2} s^{-1} from fluorescent tubes, Philips type TLD). Solutions were

refilled and condition was examined daily. Vase life was considered finished when leaves, petals, or stems lost turgidity or color.

Data were subjected to a one way ANOVA for a completely randomized design analysis and means were separated by the Tukey test ($P \leq 0.05$).

Results and discussion

Cut flower dry weight increased significantly in response to Agrostim®, Terrasorb® and Aminoquelant® either sprayed on the plants or added at the substrate as compared to the control plants (Table 2). There were no significant differences between formulates containing amino acids and low molecular weight peptides or application methods.

The rate of production of cut-flower roses in greenhouses is strongly dependent on environmental factors. The availability of assimilates is a major factor involved in the growth and flower development of rose shoots (MAAS & BAKX, 1995). Increased transport of assimilates to young shoots, either as a result of higher rates of photosynthesis or by shift in assimilate partitioning stimulated the growth and flower development in roses. The effects of carbohydrate reserves in above-ground stem parts of roses on flower shoot production has been previously reported (KOOL et al., 1996).

The pattern of N uptake has been attributed to competition within the plant for photo-assimilates and nutrients (CABRERA et al., 1995). According to this argument, N uptake is regulated by the balance between the demand for carbon and the demand for N within the various plant parts (Van der WERF & NAGEL, 1996). During periods of rapid shoot elongation, shoots and leaves become major sinks for assimilates (MARCELIS et al., 1998). However, apart from energetic aspects specific sugars may promote leaf senescence (WINGLER et al., 1998). When formulates containing amino acids and low molecular weight peptides such us Agrostim®, Terrasorb® and Aminoquelant® were used a significant amount of metabolized nitrogen was added to the plant (Table 1).

The general observation, that longevity of cut flowers produced in summer is higher than of those produced in winter supports the conclusion that carbohydrate reserves are an important determinants of vase life (DRUGE, 2000). Protein hydrolysate formulations applied to Cardinal rose plant increased in harvested stems vase life compared to the controls (Table 2). However, there was no significant differences between products or application methods of sprayed vs. substrate applications.

Under post-harvest conditions, light intensity is usually low and this limits photosynthesis. Competition for substrates may occur and if the amount is insufficient, this will result in senescence of the flower buds (BOROCHOV et al., 1976, Table 2). Complete flower bud opening of Madelon roses is dependent on the supply of "external" carbohydrates, added to the keeping solution; in contrast, Sonia roses reach complete flower bud opening and uniform maximum diameters independent of treatment, implying that the carbohydrate supply in the cut flower itself can fulfill the demands of the flower (KUIPER et al., 1996). Although the uptake of water and sucrose and their transport to the leaves would be unrestricted, the proceeding senescence clearly obstructed the transport of sucrose

TABLE 2 - Dry weight and vase life of Cardinal rose shoots from plants sprayed over five months at a weekly frequency with formulations containing amino acids and low molecular weight peptides.

PRE-HARVEST TREATMENTS	DRY WEIGHT (g plant^{-1})	VASE LIFE (days)
CONTROL	43.0 b	10.7 b
A_L	49.7 a	12.3 a
T_L	49.6 a	12.4 a
AQ_L	55.1 a	13.6 a
AQ_S	55.0 a	13.7 a
AQ_S-A_L	52.3 a	13.0 a
AQ_S-T_L	56.0 a	12.8 a
AQ_S-AQ_L	55.3 a	12.5 a
T_S	49.6 a	12.7 a
T_S-A_L	51.2 a	12.5 a
T_S-T_L	50.2 a	12.6 a
T_S-AQ_L	56.7 a	12.4 a

Different lower case letters indicate statistically significant differences ($p \leq 0.05$) between pre-harvest treatments. A_L: Agrostim® (leaf); T_L: Terrasorb® (leaf); T_S: Terrasorb® (substrate); AQ_L: Aminoquelant® (leaf) and AQ_S: Aminoquelant® (substrate).

addition may compensate for the lack in the supply of organic compounds to the flower from leaves and stalk (HO & NICHOLS, 1977). The optimal concentration of sucrose in the vase solution is determined by both the effect on the flower and the sensitivity of the foliage (HALEVY MAYAK, 1979). Pre-harvest applications of protein hydrolysates formulations would reduce the sucrose concentration required in the vase life solution.

Conclusion

Our results show that dry weight and vase life increased when formulates containing amino acids and low molecular weight peptides were applied (five months at weekly frequency); the response was independent of the application method (leaf spray or substrate drench), although the mechanism involved is a matter for future research.

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