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EFFECTS OF NITROGEN FERTILIZATION AND HAND THINNING ON BERRIES SET AND QUALITY OF "PERLETTE SEEDLESS" GRAPES.

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ABSTRACT

The effect of nitrogenous fertilization and hand thinning by brush use on thinning and clusters quality of Perlette Seedless were studied during 2003 and 2004 seasons. The fertilizer treatments were foliar application with urea (0.5 - 3 %) at full bloom time, soil fertilization with ammonium sulphate (20.5%). The data revealed that vegetative growth increased after nitrogen application. Whereas, foliar application with urea at full bloom and 50- 70 g of soil nitrogen until full bloom time were very effective in reduction flower set percentage. Furthermore, Brush use at full bloom was the optimal treatment for reducing flower set. In this respect, most treatments lead no effect on nitrogen content of leaves except treatment with 70 N units until full bloom and brush use treatment. Only vines received 70 g of soil nitrogen until full bloom time present significant effect on length and diameter of clusters. Coefficient of cluster compactness was significant affected by addition 30- 40 g of soil nitrogen until full bloom time. Foliar application with urea and 50-60 g of nitrogen significant increase berry weight, brush use gave the highest value. 0 - 3 % urea at full-bloom and 60-70 g soil nitrogen until full bloom time or brush use significantly decreased cluster weight and yield.

Soil fertilizer at 50 g N per vine had a major significant effect on yield, yield components and fruit quality compared with the control and other treatments

INTRODUTION

Perlette Seedless is an early grape maturity since it harvest at the first July under Assiut conditions, Perlette seedless table grape variety planted in narrow area in Egypt. The clusters are distinct in their compactness and earliness of maturity; the spherical berries are covered with an abundant waxy bloom, are somewhat irregular in size, and have a unique pale-gold color. In commercial production, the overly compact clusters require extensive hand thinning of berries.

The production of Perlette table grapes offers growers several challenges; the primary problems associated with the production of Perlette Seedless are its excessive vigor, higher productivity and cluster too compact and can reduce fruit quality.

Nitrogen is a primary constituent of important and common plant components such as protein, enzymes, nucleic acid, chlorophyll and vitamins (Winkler et al, 1962 and Wermelinger, 1991). In grapevines, nitrogen is essential in overall vine establishment and maintenance, fruit quality and alters plant composition much more than any other mineral nutrient (wermelinger, 1991, Angelakis and kleiwer, 1992 and Marschner, 1995), when nitrogen is sub optimal, the vine has poor vegetative growth, premature senescence of older leaves, limited fruit bud formation, and poor fruit production. Alternatively, an increase in nitrogen supply not only delays senescence but may change some plant morphology, vigorous vegetative growth, little or no fruit bud formation, and poor fruit production (Winkler et al, 1962; Araujo and Williams, 1988 and Jackson and Lombard, 1993)

Grapevines are most needed of nitrogen during the period of rapid shoot growth in the spring at bloom and early berry development. The need for N declines from midsummer to senescence (Christensen *et al* ,1978) Grapevines and deciduous fruit trees depend heavily on redistribution of N previously stored in roots, trunk, and canes or limbs to support spring growth (Alleweldt *et al* 1984, Conradie, 1986 and Peacock et al.,1989)

There are no potential risks associated with applying excess of nitrogen fertilizer until full bloom stage of Perlette Seedless as bunch rot, shatter at harvest, delayed maturity, and reduced vine fruitfulness the following year.

Urea is widely used as a nitrogen fertilizer, mostly applied through soil but also to the plant canopy (Swietlik and Faust,1984). Urea is a cheap source of fertilizer with a high N content, it can be applied as a foliar application thus eliminating the groundwater pollution associated with nitrates and potentially allowing targeted fertilizer applications to meet only the demand of growing crop.

Our research aimed to find the best treatment to maximize this target while minimizing these associated problems.

The objective of the present study was to evaluate the potential use of soil nitrogen fertilization; foliar urea and brush use for flower thinning and improvement berries quality.

MATERIALS AND METHODS

This experiment was carried out during 2003 and 2004 seasons on 55 Perlette Seedless grapevines, 5-year- old grown at the experimental vineyard, Plant Pathology Department, Faculty of Agriculture, Assiut university, Egypt. Vines were spaced 1.5 m x 3 m and were double cordon-trained at the first week of January with leaving 60 buds per vines and surface irrigation system was followed. The chosen vines were of normal growth, uniform in vigor and were divided into eleven different treatments including the control.

Five treatments were fertilized with 30 g nitrogen until full bloom time, applying as the recommended rate through this stage of growth, and the same vines were sprayed with urea, each vine received either 0 % urea (vines were sprayed with water only), 0.5%, 1 %, 2% or 3 % of urea solution (the commercial fertilizer 48.5% nitrogen) at full bloom stage and other six fertilizing treatments with nitrogen (N) were added in the wetting area under vines and mixed with the soil where each treatment received 30 , 40 , 50 , 60 or 70 N unit in form of the commercial fertilizer ammonium sulphate (20.5%) until full bloom stage then was completed by nitrogen units in the next stages. All vines were subjected to the cultural practices commonly used in this region such as using calcium superphosphate (200 kg/fed), potassium sulphate (200 kg / fed), hoeing, pest control and irrigation. The total summation of nitrogen units were 70 N units were added during season for all vines as following:

Table 1: Application time and distribution of units of nitrogen during 2003 and 2004 Seasons

Treatment number	Time of application			
	Bud burst to full bloom	**Full-bloom**	**Fruit set To verison**	**2 weeks- after harvesting**
1	30 N unit	Water spray	20 N unit	20 N unit
2	30 N unit	0.5% urea spray	20 N unit	20 N unit
3	30 N unit	1% urea spray	20 N unit	20 N unit
4	30 N unit	2 % urea spray	20 N unit	20 N unit
5	30 N unit	3 % urea spray	20 N unit	20 N unit
6 (control)	30 N unit	-	20 N unit	20 N unit
7	40 N unit	-	15 N unit	15 N unit
8	50 N unit	-	10 N unit	10 N unit
9	60 N unit	-	5 N unit	5 N unit
10	70 N unit	-	-	-
11	30 N unit	Brush use	20 N unit	20 N unit

The following parameters were determined to evaluate the effect of treatments.

1-Vegetative growth:

Twenty-five shoots were determined for measurements average length of the shoots (cm), the number of leaves per shoot and the average leaf area (cm^2) was calculated from leaves opposite to the basal clusters according to the following equation which was reported by Sourial *et al* (1985). Leaf area= 0.785x $(diameter)^2$.

2- Fruit set: Prior to bloom, three inflorescences per vine were enclosed in a bag to retain all shed flowers, the bags were removed month after full bloom and all abscised flowers and small fruit were counted. Percent fruit set was calculated as the quotient of the number of berries at harvest and the total number of flowers per inflorescence. The nitrogen content of petioles was determined using Kejldahl method (Jackson, 1960) on a sample taken three weeks after fruit set

3- Yield components: The yield (kg/ vine) was weighed at harvest time (the first week of July)' Cluster weight (g) was obtained by divining total yield per vine by the number clusters per vine which were determined by about 25 clusters per vine; cluster length (cm) and cluster diameter (cm) were recorded. One hundred berries from each treatment were chosen randomly to determine mean berry weight (g). The number of berries per cluster was calculated by dividing cluster weight by the mean berry weight.

4- Fruit composition: A sample of 10 clusters per treatment was crushed for determination of total soluble solids, total acidity and TSS% / acid ratio according to A.O.A.C (1975).

Statistical analysis: The experiment was conducted in a randomized complete block design (RCBD) according to (Mead et al, 1993). Data were statistically analyzed by using SPSS (SPSS Inc.) Analysis of variance was carried out using a general one-way model, and student-Newman-Keuls (S-N-K) was used for comparison between particular means.

RESULTS AND DISCUSSION

Fig (1A) shows that all treatments significantly increased shoot length, leaf area and number of leaves compared with vines sprayed by water except vines which were treated with low levels of nitrogen until full bloom time or brush use and that had no significant effect on leaves number. Increases in vegetative growth were proportional to the increase in nitrogen level. The maximum vegetative growth was obtained when the vines were fertilized with 60 or 70 g / vine until full bloom time.

These results are in agreement with those obtained by Dhillon *et al* (1992) who reported that the increase nitrogen level from 0 – 125 g per vine caused strong vegetative growth of Perlette grapevines. Growth in low N limits the development of the shoot and root, and therefore the capacity for utilization of the additional photoassimilate, and may therefore exacerbate the accumulation of carbohydrate observed in leaves (Webber et al., 1994), and by limitation of sink development rather than being a direct effect of N supply on photosynthesis. This may explain increase the set of berries per cluster. Alternatively, under high N protein increase and significant increase CO_2-saturated rate of photosynthesis in these leaves and can alter gene expression (Paul and Driscoll, 1997; Scheible et al., 1997) and could lead to reduction in the berries set.

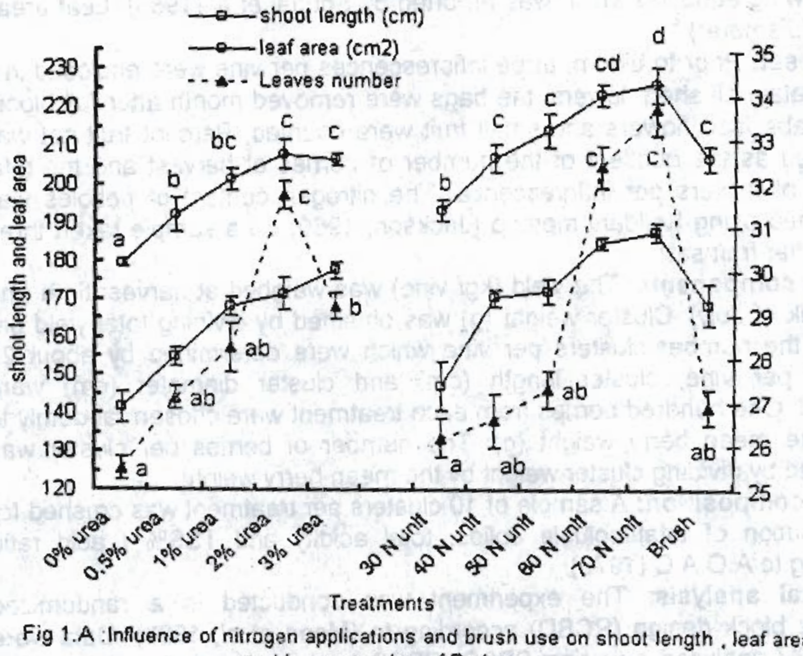

Fig 1.A :Influence of nitrogen applications and brush use on shoot length , leaf area and leaves number of Perlette grapes.

Shoot length and rachis weight were a better predictor of leaf area per shoot than leaf number and rachis number. Ninety-one percent of the total variation could be explained by shoot length compared to only 67 percent for leaves number and 88 percent to rachis weight than 71 percent for rachis number. (Fig.1B).

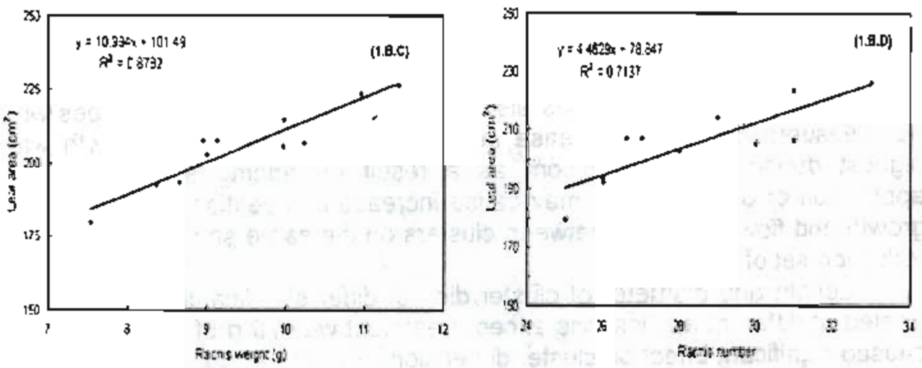

Fig 1B. Relationship between shoot length (A), leaves number (B), rachis weight (C) and rachis number (D) on leaf area of Perlette Seedless grapevines.

From Fig (2) it is evident that foliar application of urea (0-3%) and 50-70 g of soil nitrogen application until full bloom time significant decrease berries set by about (26 -35 %) and 9 -27 %, respectively compared with 30 – 40 g of nitrogen.

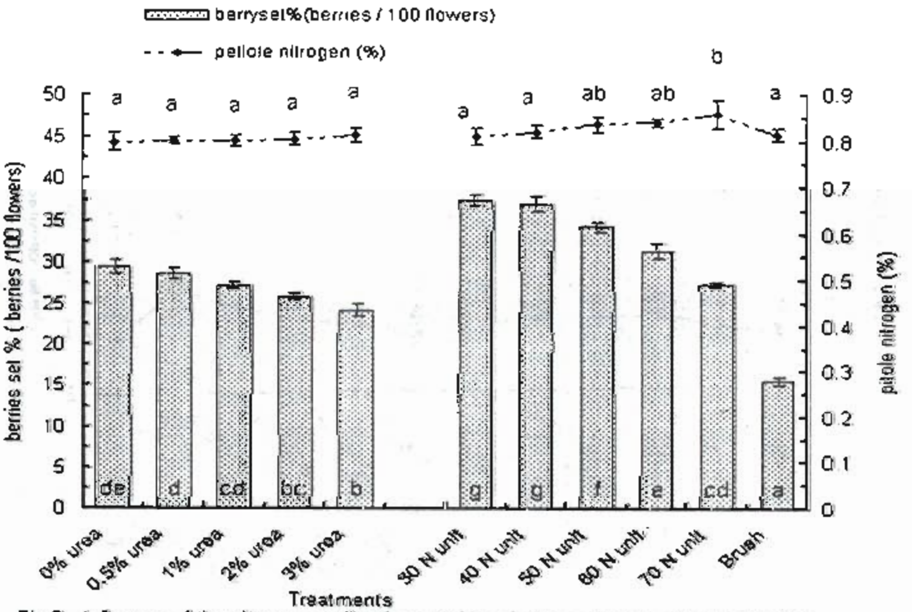

Fig 2 : Influence of the nitrogen applications and brush use on berries set % and pitole nitrogen (%) of Perlette grapes.

No significant effect found between water spray and urea application at 0.5 –1%. The best treatment for cluster thinning was by brush use that caused reduction in flower set by about 58 % compared with control All treatments had no effect on nitrogen content of leaves only, 70 g of nitrogen per vine until full bloom time significantly increased nitrogen content of leaves. Significant positive correlation was found between total nitrogen content of leaves and leaf area (R^2= 0.622).

These results supported by Fleming and Alderter (1949) and Boynton (1954) who found that urea has also been tried on peaches and grapes with no measured benefit or increase in leaf nitrogen level. Shoot growth was highest during period of bloom as a result for adding soil nitrogen or application of urea and this may cause increase competition between shoot growth and flower set and between clusters on the same shoot which lead to reduction set of berries.

Length and diameter of cluster did not differ significantly among vines treated at different applications except treatment with 70 g of nitrogen, which caused significant effect on cluster dimension.

Water spraying significantly decreased cluster compactness coefficient by about 13 % than those from the vines were fertilized with30 g of nitrogen until full bloom time and 23 – 28 % by foliar applied urea. Soil nitrogen at 60-70 g significantly decreased cluster compactness coefficient by about 22-33 %, respectively and 38 % by brush use (Fig 3)

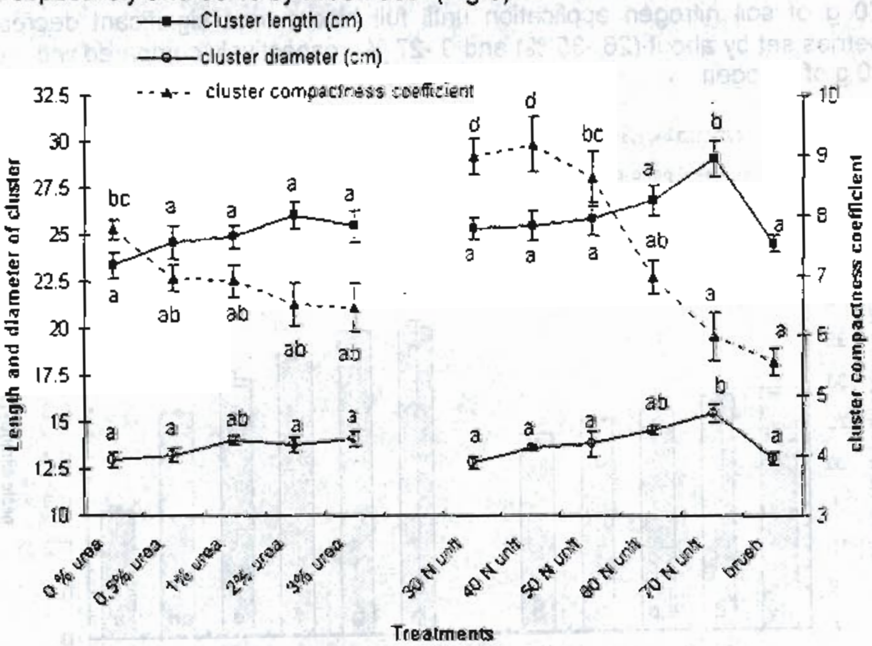

Fig 3: Influnce of nitrogen applications and brush use on length ,diameter and compactness coefficient of cluster of Perlette grape.

These results may be to the positive effect for treatments on length and diameter of cluster and set of berries.

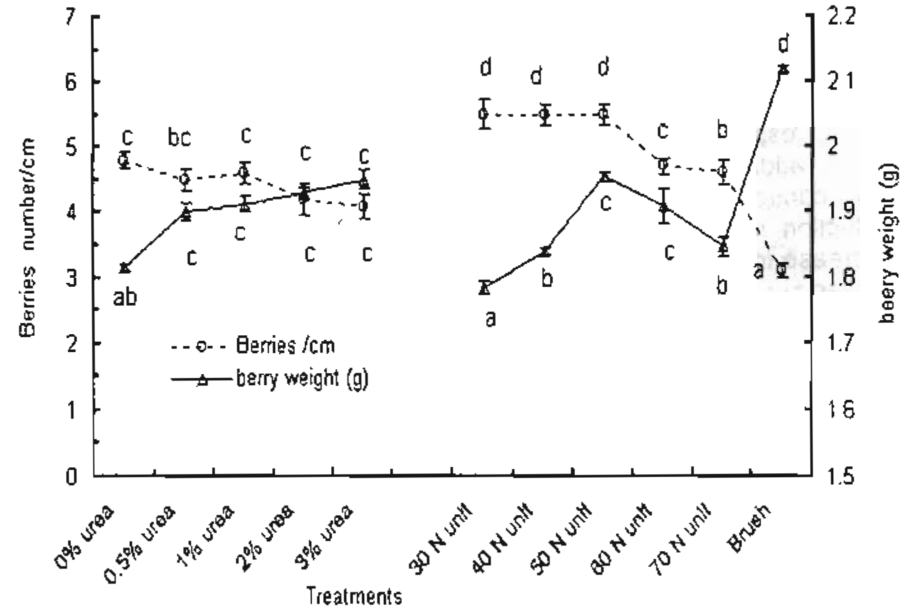

Fig 4 : Influence of the nitrogen applications and brush use on berries number /cm and berry weight of Perlette grapes

The thinning effectiveness of treatments evaluated by the number of berries per centimeter of lateral length. There was a significant reduction in berry density per lateral length with full bloom applied urea at 2-3 % and by brush. No thinning was obtained when vines were sprayed with 0.5 - 1% urea or were fertilized with 60-70 g nitrogen. While, the increase in berry density per cm of lateral was significant with 30-5o g soil nitrogen until full bloom time. The higher thinning occurred by the treatment with brush at full bloom time. Increases in berry weight were significant by all treatments and progressively by increasing rate of urea and nitrogen, with exception 30-50 g soil nitrogen application. The treatment with brush was the best for increased berry weight (Fig 4).

The final number of berries per cluster significantly decreased by foliar application of urea at all concentrations (0- 3 %), 60 or 70 g nitrogen per vine until full bloom and brush treatment, but no effect by treatment with 30,40 or 50 g of nitrogen per vine, all treatment were compared with 30 g of nitrogen until full bloom (control vines). These decreases largely reflect those observed in berry set. The highest reduction in number of berries per cluster was recorded on clusters were treated with brush use followed by treated with 0.5-3% urea followed by 70 g nitrogen per vine. Hand thinning by brush showed 40 % decrease in final berries per cluster compared with 30 g of nitrogen (control) and by about 25 % decrease by foliar application of urea at all levels. These results may be due to vegetative growth enhancement at set time and the competition between growth of shoots and set of berries. Foliar urea application through the canopy may be preferable to soil application during full bloom time to reduce the final number of berries per cluster. Significant positive correlation was found between the final number of berries per cluster and total yield per vine (R^2= 0.956) and significant negative correlation with TSS/acid ratio.

Foliar applied urea at all concentrations (0 – 3 %) and adding 60 - 70 g of nitrogen significantly decreased cluster weight by about 17-19 % and 10-19 %, respectively compared to adding 30 g per vine until full bloom time. While, adding 40 - 50 g nitrogen per vine significant increase cluster weight than control vines. On the other hand, the tinning by brush showed 25 % reduction in cluster weight compared with the control vines (Fig 5). The decrease in cluster weight can be attributed to decrease the final number of berries per cluster.

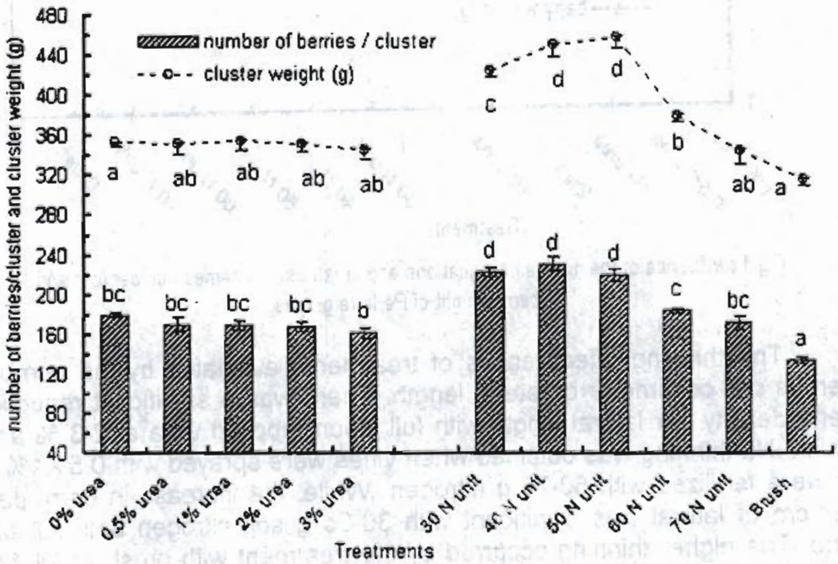

Fig 5 : Influence of the nitrogen applications and brush use on number and weight of berries per cluster of Perlette grapes

The yield weight per vine for two consecutive seasons show in (Fig 6). Yield weight decreased with foliar applied urea at full bloom time. No significant effect between urea application and water spraying in the two seasons. While the significant effect found between soil treatments and urea spraying through the canopy. Maximum yield was obtained on vines receiving 40-50 g of nitrogen until full bloom time. On contrast, brush use significant reduced the yield by about 27% and 18%, respectively. Compared with control in the two seasons.

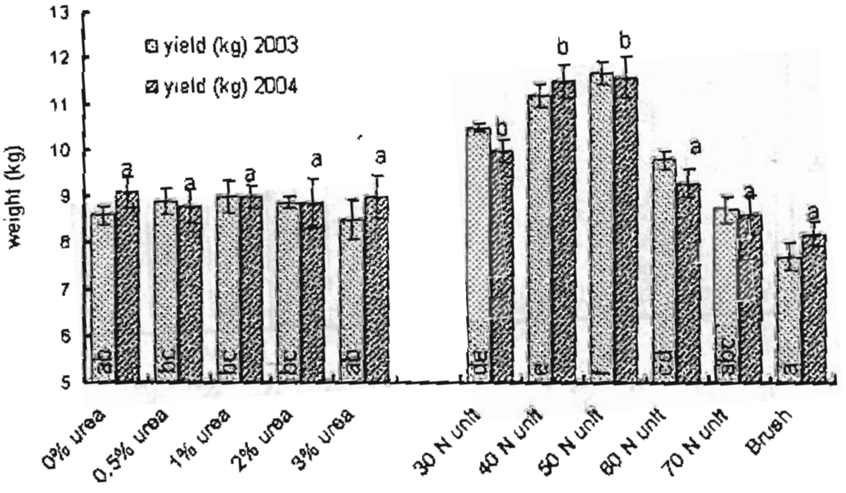

Fig 6 : Influence of nitrogen applications and brush use on yield weight of Perlette grapes.

Highly significant positive correlations were found between yield and cluster weight (R^2 = 0.996) and between yield weight and berries number (R^2= 0.956).

Increment of yield weight per vine was mainly due to increasing cluster weight, which resulted from increasing berry set and berry weight.

Fruit quality at harvest was affected by the treatments. Foliar application of urea with (0.5 - 3 %) at full bloom or (50- 70 g) nitrogen until full-bloom time via soil significantly increased total soluble solids and TSS/acid ratio compared with control vines. However, water spray or nitrogen fertilizer at 40 g had no effect on TSS / acid ratio.

Acidity took the contrast trend. Brush use gives the minimum value for acidity percentage, this enhancement in fruit quality may attributed to reduction of nitrogen in the next stages of vine development (from full bloom to harvest date) that not only decreases cytokinins activity in the shoots (because the amount of total cytokinins exported by the roots is lower in nitrogen-depleted than in nitrogen-sufficient) and simultaneously accelerates senescence but also increases ABA content (Wagner and Beck, 1993; Nikolaos *et al*, 2000) (Fig 7).

Significant negative correlation was found between acidity and TSS % / acid ratio (R^2= 0.950). The action of nitrogen fertilization on berry TSS % were obtained in this study is in agreement with Ahlawat and Yamdagni (1988), and Dhillon *et al* (1992) who found that the lowest levels of nitrogen application (25 and 50 g) per vine improves fruit quality of Perlette grapes.

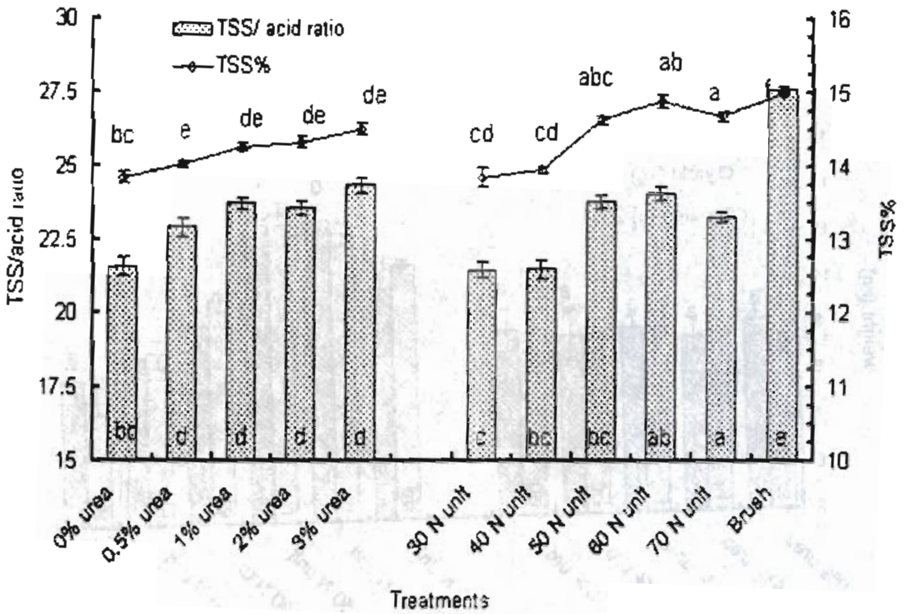

Fig 7 Influence of the nitrogen applications and brush use on TSS% and TSS / acid ratio of Perlette grapes

Conclusions

Treatments used in this experiment were targeted to utilization from critical time during full bloom to reduction the final number of berries per cluster,

By application of soil nitrogen fertilizer, water or urea spraying and hand thinning with brush without much effect on weight of yield and produced clusters are higher quality of Perlette grapes

Results obtained in this study indicate that foliar application with water or urea at 0.5 % to 3 % significantly decreased fruit set % and sequence the final berries number per cluster and yield weight. Furthermore, 60-or70 g of N until full bloom time significantly decreased the final number of berries per cluster and yield by about 7% and 15%, respectively. While, 50 g of soil N fertilizer until full bloom gave the higher yield by about (14%) and berry weight with high quality of juice berries compared with control and other treatments. Brush use gave the better fruit quality (the lowest number of berries per cluster, the higher berry weight and the higher TSS /acid ratio), but also gave the lowest weight of yield at all by about 23% at two seasons

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تأثير التسميد النيتروجيني والخف اليدوي على العقد وجودة الثمار لعنب البيرليت اللابذرى ٠

ياسر أنور محمود محمد عمران ، فرج محمد المرسى و محفوظ محمد الموجى
قسم بحوث العنب- معهد بحوث البساتين- مركز البحوث الزراعية- الجيزه- مصر.

تم دراسة تأثير التسميد النيتروجيني والخف اليدوي بالفرشاة على خف وجودة عناقيد عنب البيرليت اللابذرى خلال موسمي ٢٠٠٣ و٢٠٠٤ . معاملات التسميد كانت عن طريق رش اليوريا بتركيز صفر % (كرمات رشت بالماء) - ٠,٥ % - ١ %- ٢ % أو ٣ % عند قمة التزهير أو عن طريق التسميد النيتروجين الأرضي بسلفات الامونيا (٢٠,٥%) بجرعات ٣٠ (كنترول للمقارنة) - ٤٠- ٥٠- ٦٠ أو ٧٠ وحدة أزوت تمت إضافتها حتى وقت قمة التزهير ثم كملت باقي وحدات التسميد للمعاملات كما بالجدول (١) وكان مجموع وحدات التسميد التي أخذتها الكرمات طوال موسم النمو هي ٧٠ وحدة أزوت.

وكان من أهم النتائج المتحصل عليها ما يلى :

زيادة النمو الخضري بعد التسميد الازوتي . رش اليوريا أو التسميد الأرضي بمعدل ٥٠- ٧٠ وحدة أزوت حتى وقت التزهير أدى إلى انخفاض نسبة العقد. المعاملة المثالية لخف الأزهار كانت باستعمال الفرشاة وقت قمة التزهير. لم تؤثر معظم المعاملات على محتوى الأوراق من النيتروجين باستثناء التسميد بمعدل ٧٠ وحدة أزوت. فقط الكرمات التي سمدت بمعدل ٧٠ وحدة أزوت أثرت معنويا بالزيادة على طول وقطر العنقود. معامل تزاحم العنقود زاد معنويا بإضافة ٣٠- ٤٠ وحدة أزوت حتى وقت التزهير. رش اليوريا و التسميد بمعدل ٥٠ - ٦٠ وحدة أزوت زودت معنويا وزن الحبات بينما استعمال الفرشاة أعطى أعلى القيم. رش الماء أو اليوريا بكل التركيزات ، التسميد بمعدل٦٠ - ٧٠ وحدة أزوت أو استعمال الفرشاة قلل معنويا وزن العنقود و المحصول في حين أن التسميد بمعدل ٥٠ وحدة ازوت أوجد تأثيرات معنوية كبيرة على وزن المحصول ومكوناته وجودة الثمار مقارنة بالكنترول أو بباقي المعاملات.