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FOLIAR-AND SOIL-APPLIED BIOSTIMULANTS FOR BELLPEPPERS IN FLORIDA

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ABSTRACT. The response of bellpeppers (*Capsicum annuum* L.) to 11 foliar – or soil – applied biostimulants was evaluated for several seasons in west-central Florida (lat. 27° 30' N; long. 82° 30' W). The bellpeppers were grown with the full-bed polyethylene mulch production system with micro-(trickle-) irrigation. Among the products investigated were seaweed extracts, aketo-carboxylic- and amino-acids, cytokinins, mono-nitrophenolates, hydrogel polymers, as well as various macro – and micronutrients in water-soluble forms. The compounds were applied according to manufacturers' recommendation. A few of the biostimulant products increased early (first two harvests) yield and fruit size compared to water control. The beneficial effect of biostimulants, however depended on the bellpepper cultivars. The biostimulant products had very little, mainly non-significant, effect on macro-and microelemental concentrations in pepper leaves and fruits

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ADAPTATION OF A REGRESSION MODEL FOR THE FERTILIZATION OF PEPPER *Capsicum annuum* L. TIPE "ANCHO SAN LUIS" IN THE EXPERIMENTAL FIELD OF THE CIIDIR-IPN UNIDAD DURANGO

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INTRODUCTION. The pepper (*C. annuum* L.) it is one of the vegetables of great importance in the international market, occupying Mexico the 4th place in the world production. In our country the pepper is an important vegetable being cultivated annually around 110,000 hectares. Durango is the 5th producing of dry pepper and the 9th in green pepper, the area producer but important it is located in the southeast of the well-known entity as The Valley of "Poanas", with a census of 1,122 producers that annually cultivate around 3,000 hectares representing an important source of temporary employments. The wide pepper is one of the varieties that more it is cultivated in this area they can harvest it so much in green as for dry registering low levels production levels on the average (8 ton Ha^{-1} in green pepper and 1.3 ton Ha^{-1} dry pepper), this is owed among other factors to that it stops their cultivation they use technical traditional, to the drop fertility of the floors and high densities of plant (35 thousand plants for hectare) without an appropriate fertilization. This is an important cultivate, but they have not elaborate agronomic studies local on fertilization tests that allow to obtain appropriate technologies to the conditions of the soil and climate of tha area. For it the present work has as objective to evaluate the respond of the pepper wide type "San Luis" to the application of different nitrogen levels (N), match (P) and potassium (K).

METHODOLOGY. The study was carried out during the cycle S-S 1999 in the experimental field of the CIIDIR-IPN-DGO., in a soil young sandy crumb and of low fertility located in Vicente Guerrero, Dgo., for the design of treatments the main " Plan Puebla II " was used with an exploration space for the independent variables from 60 to 180 kg of N/ha-1, of 20 to 120 kg, of P/ha-1 and of 0 to 100 kg of K/ha-1, under an experimental design of complete blocks at hazard with 15 treatments and four repetitions. The experimental unit conformed to of four furrows with a distance of 80cm between furrows and 5m of long, the useful parcel was the two central furrows. The fertilization was made in two parts, the first one you applies to the 8 days after the transplant and the second to the 70 days. The program SAS was used to carry out the statistical analysis.

RESULTS. The regression analysis with the complete pattern (table 1) expressed highly significant differences for the lineal effects of the nitrogen and the match and significant for the potassium, highly significant for the quadratic effect of the match, significant for the quadratic effect of the potassium and, significant the interaction simple NP, the rest of the variables of the pattern is not significant.

Table1. Analysis of variance of the regression with the I model complete the one.

Source of variation	Degrees of freedom	Adds of squares	Square means	F Calculated
MODEL	10	12'537,216	1'253,721	87.18**
N	1	10'691,493	10'691,493	743.45**
P	1	1'395,632	1'395,632	97.05**
K	1	90,079	90,079	6.26*
N^2	1	48,558	48,558	3.38
P^2	1	129,268	129,268	8.99**
K^2	1	69,421	69,421	4.83*
NK	1	10,464	10,464	0.73
PK	1	200	200	0.01
NPK	1	32,810	32,810	2.28
Error	49	704,661	14,380	
Total	59	13'241,878		

* * Differs highly significant and * Differs significant

Table 2. Model of regression the explains yield of dry pepper.

Variable	Degrees of freedom	Parameter dear	Standard Error
Intercept	1	-691.829561	272.07000000
N	1	5.564267	2.74612776
P	1	10.640194	3.96732154
K	1	7.344712	2.19450711
P^2	1	-0.102094	0.02471852
K^2	1	-0.053998	0.02049713
NP	1	0.086138	0.03836923

The result of the regression (Table 2) with the method Backward of the SAS is like it continues:

$$Y = -692 + 5.564267\,(N) + 10.640194\,(P) + 7.344712\,(K) - 0.102094\,(P)^2 - 0.053998\,(K)^2 + 0.086138\,(NP)$$

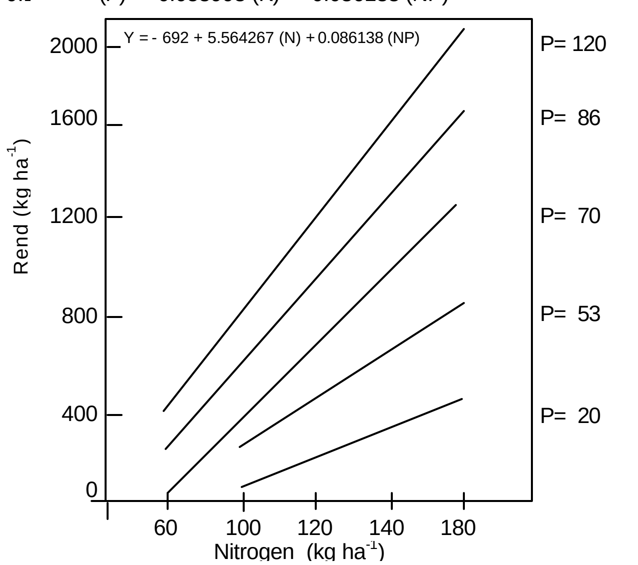
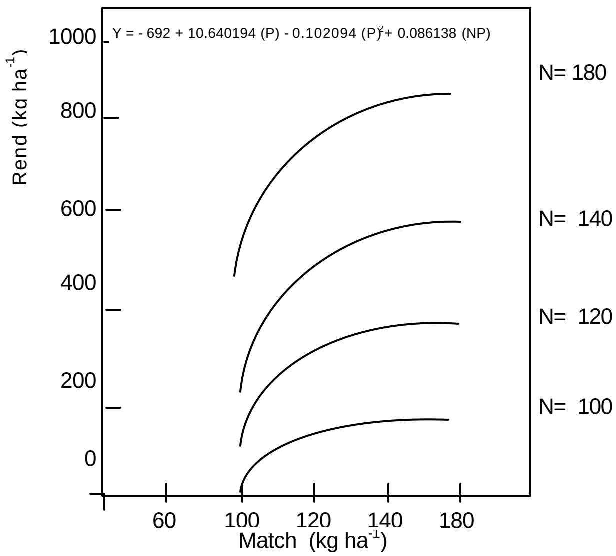


Figure 1. Behavior of the nitrogen in their different application levels.



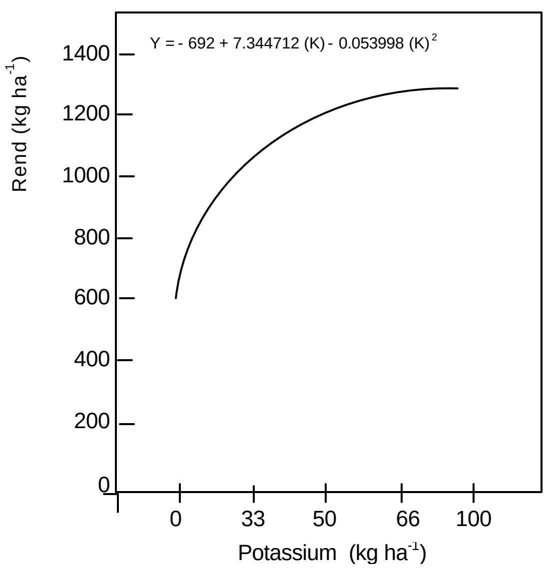


Figure 3. Behavior of the Potassium in their different application levels.

CONCLUSIONS AND RECOMMENDATIONS

- Positive answer existed to the main effects of N, P and K.
- The interaction NP was important for the increment of the yield.
- The answer of the nitrogen according to the graph corresponds a model of regression of first order.
- The answer of the match and the potassium observed in the graphs correspond a model of regression of second order.
- It is recommended to continue investigating on the nutrition of the pepper cultivation to obtain appropriate fertilization technologies to the study area.
- For similar studies to this, it is recommended to enlarge the space of exploration of the nitrogen.

CULTURAL SYSTEMS FOR HABANERO PEPPER FOR CAPSAICIN PRODUCTION

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The use of Habanero type peppers for capsaicin production has been proposed as a new crop and part of the NC Speciality Crops Program. In 2001 we attempted to assist in the development of a new industry in the coastal Plain of North Carolina. We took a two pronged approach: growing product on grower fields with the Best Management Practices (BMP) know at present and conducted large research trails to refine these BMPs. We grew from one to two acres of habanero pepper on nine farms within a 30 mile radius of Kinston, NC. During the season we monitored crop production practices and advised growers on various cultural practices. Our research trials evaluated frequency of sidedress fertilization and we determined that application of 18 kg of N per ha one, two or three times did not differ in production or plant growth. We compared plant populations of 12.3 to 31 m per ha and found only slight variations in yield. We are awaiting laboratory analysis for determination of the yield of capsaicin per hectare from these trials.

HABANERO PEPPER PRODUCTION IN THE PENINSULA OF YUCATAN, MEXICO

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INTRODUCTION. *Capsicum chinense* Jacq is a domesticated species of hot pepper which is the most variable and widespread within Latin America. In the Peninsula of Yucatan, Mexico, this pepper is known as Habanero pepper and is an important crop. Some 2,500 hectares per year are planted to this species and the sown area shows an increase every year. Local fresh market is the main destination of production; some are used for pickles and other industrial preparations, export being a small fraction of total production. The preferred color of the fruit is orange or yellow.

The main area planted to this crop is in stony soils in Yucatan state. These soils have low production potential, but if technology developed by INIFAP is applied, yields obtained should be over 20 ton/ha of commercial fruit. In deep soils yields can be more than 25 ton/ha.

PLANT CHARACTERISTICS. The Habanero plant has semi-determinate growth; its life cycle being some 200 days. The stem is erect with three to five secondary branches and nine to twelve tertiary branches. Leaves are 12 to 18 centimeters long and 9 to 12 centimeters wide. Height varies from 80 to 120 centimeters.

Usually there are four to eight fruits per armpit. The fruits have three to four locules. Size of fruit varies from three to eight centimeters in length and from two to four centimeters in width. Color of mature fruits may be orange, yellow, red or brown. All kinds of Habanero pepper grown in Yucatan Peninsula are very hot and scented.

TECHNOLOGY DESCRIPTION. Farmers use local varieties and produce their own seed. They collect the seeds of the bigger ripe fruits. Recently, some companies have produced certified seed derived from local sources. Farmers use 300 grams of seed per hectare.

This crop may be grown during all the year with some variations in yield. Higher yields are obtained in the rainy season. On the other hand, production in the dry season is difficult because of plant health problems.

This crop requires supplementary irrigation because rain doesn't provide enough water for its development. Must of the growers use a traditional hose irrigation system. However, drip irrigation is more efficient and requires less labor. This system offers the possibility of application of agrichemicals in irrigation water (quimigation).

Habanero pepper also requires application of all nutrients for high yields, because must of soils in which it is grown are poor. The amount of fertilizer applied is dependent of soil fertility levels. Fertilizers may be applied by hand or through irrigation water (fertigation) in drip irrigation systems. Foliar fertilization is necessary too.

Recommended doses of macronutrients for this crop vary between 150kg/ha and 210kg/ha of nitrogen, between 100kg/ha and 130 kg/ha of phosphorus, and between 150kg/ha and 170kg/ha of potassium, depending on soil fertility and on production systems.

Crop management includes control of weeds, pests and diseases, because weather conditions are favorable for high populations of pathological agents which are the cause of high yield reductions if control is inadequate.

Weed control may be done through manual, chemical or combined methods; and most of farmers adopt the last one. Annual weeds are the main problem; and three to four weedings are necessary during the production cycle.

On the other hand, whiteflies and podborer, are the main pests. Whiteflies are of special importance as vectors of virus diseases. Leafminer, and fruitworm are pests that can produce significant damage if not controlled.

Habanero pepper is attacked by several diseases caused by viruses, bacteria, fungi and nematodes. The main diseases are Cercospora leafspot, bacterial spot, bacterial wilt, and pepper wilt. Nematodes are of importance in certain areas.

Chemical control is the main method used by farmers to control pests and diseases. Pesticides should be chosen carefully.

HARVEST AND COMMERCIALIZATION. Habanero pepper harvest begins some eighty days after planting. The interval between two pickings is between seven and ten days and the harvest lasts for three months.

Fruits should be classified before being sent to market. There are three classes of commercial fruits: large (10 grams or more), medium (7.5 to 10 grams), and small (5.0 to 7.5 grams). Fruit quality is determined by size, color, weight, appearance and hardness.

Higher exports of fresh Habanero fruits to the United States of America have been the cause of an increase in the cultivated area in the last few years. New cultivated areas are to be found in Campeche and Quintana Roo states, because deep soils are better for pepper production.

MANAGEMENT OF BORIC NUTRITION IN JALAPEÑO PEPPER (*Capsicum annuum*), IN TRICKLE IRRIGATION SYSTEMS

By Mario Berrios, WSNPK Manager, SQM México.

The trickle irrigation systems development and fertigation have allowed to the incorporation of balanced balanced nutritive solutions in jalapeño pepper cultivation (Capsicu annum) in large parts of Mexico, achieving a significant increase in yields and final cultivated product quality. In recent years an optimal balance of macroelements have been determined, but still there are several doubts about balances and microelement concentrations, especially in regard to boron for jalapeño pepper cultivation.

In the case of boron, the more important functions for jalapeño pepper cultivation are related, on one hand, to sugar transportation from leaves to fruit, thus achieving this greater weight and quality, and on the other, to the flowering process improvements, being this determinant in the pollen feasibility as well as in size and flower color.

Frequently, in Mexico the boron application has been made on the base previous to transplantation, via foliar irrigation or via fertilization by irrigation, not in a continuous way, but in a sporadic, neglecting the optimal concentrations for its better utilization as well as its relationship with other ions, especially with Calcium.

Tests made on Northwest states of Mexico in jalapeño pepper cultivation, exposed to high temperatures (42°C) and low relative humidity (25% HR), where the falling of flowers was an important aspect to correct, demonstrated that a proper use of boric nutrition in tickle irrigation systems improve the flower pollination process, avoiding flower fall and increasing the quantity of mature fruits and consequently, final cultivation yields.

In general, irrigation water on that area has a boron concentration varying from 0.3 to 0.5 ppm, with which normally for that cultivation, it would not be necessary to incorporate to the nutritive solution of irrigation any boron source. Nevertheless, in extreme weather conditions the addition of boron to nutritive solutions to obtain a concentration of 1 ppm had important results on the pollination process, and maturity of the fruit. The boron source used for trickle irrigation systems was Boric Acid (17,5 B) and its application was made on each watering.

The optimal rank of boron concentration in nutritive solutions must go from 0.5 to 1 ppm, but becoming phytotoxic if concentration in the solution exceeds 2 ppm. This is the reason why it is not advisable to make sporadic boron applications in high concentrations, but it is advisable to incorporate it continuously in lower doses.

It is not only important to maintain the boron in a proper concentration, but also it is important to maintain an optimal relationship with other microelements and especially with calcium.

Calcium and boron have the characteristic of being absorbed and transported to the plant´s interior through a flow of exudation current and they also have, depending on their levels in the solution, a synergic or antagonic behavior.

Plant roots absorb boron as boric acid (H3BO4), so it is incorporated to the flood of sap.

If calcium is applied instead of boron, or if boron is applied in lower concentrations, deficiencies on this element may occur.

For boron concentrations of 1 ppm it is recommended to work with calcium concentrations from 5 meq/lt to 10 meq/lt.

In a word, in jalapeño pepper cultivation, a proper boron concentration in nutritive solutions must be maintained, so that it fluctuates from 0.5 to 1 ppm. In extreme temperatures and humidity conditions these concentrations must be increased at least to 1 ppm in order to support the flowering process and maturity of fruits. Never exceed concentrations in nutritive solution of 2 ppm because there is risk of phytotoxity.

In addition to maintaining a correct boron concentration, it is important to keep its relationship with the calcium ion, so as to favor its synergism in absorption.

Boric acid worked very well as a proper source of soluble boron for trickle irrigation systems, without any problem of dropper clogging, due to the fact that is a quick assimilable boron source for the ionic way in which it is absorbed by the plant.

PREVENTION OF CA-DEFICIENCY IN PEPPER (*CAPSICUM ANNUUM* L.) USING MAGNUM - P44® THROUGH DRIP IRRIGATION

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Summary

Use of drip irrigation and more so of fertigation increases rapidly in many arid regions of the world. This is mainly due to various potential benefits such as fertilizer, water and labour savings, more precise management options such as controlled salinity, fewer weed problems, etc.

While nutrients such as N and K are easily applied through drip systems, P is more difficult to apply when focusing on proper distribution in the rooting zone. Acidic P-fertilizers such as Magnum-P44® offer various advantages, e.g. by increasing the amounts of plant available macro- and micronutrients, particularly under prevalence of alkaline soils and hard water (rich in bicarbonates) and by reducing the risks of precipitate formation, e.g. Ca- and Mg-phosphates, which are unavailable to plants and which may clog dripping systems. On the other hand calcium-deficiency-related disorders are widespread, e.g. in fast-growing and low-transpiring organs, and this may lead to low yields of marketable fruits: blossom end rot in tomato or watermelon, bitter pit in apple, tipburn in lettuce and blackheart in celery are common paraphrases for the symptoms of this economically very important disorder.

In Alyadwdh, Jordan, a site with heavy-textured, alkaline and calcareous soil conditions (pH 7.6, $CaCO_3$: 4.95 %), a replicated trial with 10 pepper varieties (*Capsicum annuum* L.) differing in their susceptibility to Ca-deficiency were grown under plastic houses in the 2002 summer season. From early fruiting stage onwards two fertigation programmes (treatments I and II) were established, in order to evaluate their potential to eliminate this common nutrient deficiency. These treatments mainly differed with regard to the choice of the P-fertilizer: In the treatment (I) using Magnum- P44® as a P-source, no calcium and magnesium was applied, whereas the programme (II) using a compound fertilizer product, Ca-and Mg-nitrate was added. Both fertigation programmes used similar amounts of N, P, K. Fertigation was done twice a week. Classification of the degree in Ca-deficiency was done by a visual scoring (0-10) in three different growth stages of the crop. While most of the varieties of treatment (II) received high scores for Ca-deficiency (medium to severe deficiency symptoms) even with frequent fertilizer applications through the drip system, 50 % of the varieties under treatment (I) fully and 20 % slightly had recovered from medium to severe Ca-deficiency stress approx. 3 weeks after the start of the fertigation programme. This was underlined scores for Ca-deficiency which were significantly lower compared to the scores reached in treatment (II). The trend of decreasing Ca-deficiency scores in treatment (I) continued during the trial period. The results are discussed in view of proper choice of P-fertilizers under alkaline soil conditions with special emphasis on benefits of using Magnum- P44®

EFFECT OF CONTROLLED ATMOSPHERE STORAGE ON THE RESPIRATION RATE OF CHILE POBLANO (ANCHO)

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Keywords: Controlled atmospheres (CA), Chile Poblano, Chile Ancho, *Capsicum annum*, green pepper

Abstract. Chile Poblano or ancho (Green Pepper) (*Capsicum annum*) was treated with several controlled atmospheres (CA). Oxygen concentrations of 5,10 & 15% and the control at 21%-. Also, CO_2 effect was evaluated, at 0, 5 and 10% CO_2 with 5 &10% O_2 at temperatures of 0 and 5°C. At temperature of 0°C, the pepper presented the lowest respiration rate, while the respiration rates of those atmospheres without CO_2 added (5%O_2 with 0%CO_2) showed values in the ranges of 1.5- 4 .5 ml O_2/Kg.h and the same percentage of O_2 but with 5% of CO_2 the range values were around 1-3.5 ml O_2/Kgh at 0°C of temperature. Given the variability of the results, respiration rates were analyzed to develop a model as a function of different parameters (O_2 and CO_2 concentrations, temperature and time). We tried also to adjust our data to Arrhenius and Michaelis-Menten models, to observe the temperature effect, since these models have been reported by different researchers; however, our data fit only the Arrehnius equation, and did not fit the Michaelis Menten model, so by using Non Linear Analysis, an empirical model was built that resulted in a better fit of the experimental data.

Introduction. Green pepper poblano (*Capsicum annum*), it is product widely consumed in Mexico. Unfortunately, its shelf life is very short, reason why its availability is limited by the periods of harvest of different producing regions. Many studies on pepper, at the international level, have been carried out with bell pepper; nevertheless, for the type of chile poblano given the economic impact of this crop, there exists a gap on postharvest information. With respect to the postharvest handling of this product, unfortunately, technology is not applied. For this reason, the life of this product fluctuates between 1 and 2 weeks, with considerable losses for the farmers. Controlled atmosphere storage (CAS) is an excellent alternative to extend the shelf life of this pepper. One goal in Controlled Atmosphere Storage studies, is to model respiration rate of fruits and vegetables subjected to different gas concentrations. Many researches have attempted to model respiration rate. and the investigators are continuously on the matter (Hagger et al., 1992). These efforts are often limited by the data that can practically be used for the quality control procedures and the modeling of such (Shiina and Haruenkit, 1997). In light of the above, this study was aimed toward respiration rate determination of wide green pepper c.v. "poblano" under different conditions of Controlled Atmosphere and its adjustment to different mathematical models.

Materials and methods. The pepper Poblano or ancho was purchased from a local distributor "Chilera Serrano" of the Francisco Villa Market of the City of Durango, Mexico, within 24 hrs after harvest or the same day of harvest. The peppers were washed with water and soap, its weight and volume were determined; they were disinfected in a solution of sodium hypoclorite with 200 ppm for 5 minutes. Peppers were drained, dried and placed in the glass chambers in an average of eight peppers per jar.

The atmospheres evaluated were: O_2 concentrations of 5, 10 y 15% and the control at 21% and stored at 5°C of temperature (Experiment "A"; chile from Vicente Guerrero and Poanas, Dgo.). Another experiment, aimed to evaluate the effect of CO_2 in conjunction with O_2 utilized 5 and 10% O_2 with 0, 5 and 10 % of CO_2 and a control of 21% of O_2 and 0% of CO_2 (Experiment "B", chile from Sinaloa and Zacatecas states) at 0°C of temperature. A last experiment was carried out at 5, 10 and 21 % of O_2 with 0 and 10% of CO_2 at temperature of 0° (Experiment "C", chile from Poanas, Dgo). The gases analyzed were carbon dioxide and oxygen according to the methodology described in Enríquez-Castro, (1997). A gas chromatograph GOW MAC series 580 (Gow Mac Instrument Co Bethlehem, PA) equipped with a CTR-I column. The carrier gas was helium with a flow rate of 60 ml/min. The thermal conductivity detector was operated to 100 mA; the temperature in the port of injection and in the furnace was maintained at 90 ºC, the column was maintained at 38ºC.These measurements were made every 24 hours approximately, taking 1 ml samples from the head space with a syringe. The respiration rates were calculated and analyzed using the software STATISTICA for Windows, version 4.3, (Statsoftt, Inc., 1993, U. A.) with a level of significance of 5% (p £ 0,05).

Results and Discussion. From the rates of respiration obtained, an analysis was carried out using a multiple linear regression model (Statistica v.4.3).
For the case of the rate of respiration as consumption of O_2, the following mathematical model is obtained, with a standard of 5.3895 and $R = 0.8072$

$$ml\ O_2 / Kg.h = 36.7863 + 1.09\ O_2T^o - 0.40\ T^o t - 0.18\ Origin - 0.24\ O_2 t + 0.124\ O_2 - O.22 O_2 T + 0.184\ CO_2 + 0.18t \quad \text{(Eq.1)}$$

With respect to the rate of respiration as CO_2 production it has an standard error of 4.5240 and one R=0.8440. The mathematical model obtained was:

$$mlCO_2 / Kg.h = 64,2048 + 0,767\ T^o - 0,32\ Origin - 0.23 O_2 CO_2 + 0.172O2 - 0,11\ O_2 t + 0,182\ CO_2 t^o \quad \text{(Eq. 2)}$$

To evaluate the effect of temperature on respiration rate, results obtained experimentally were adjusted to the model of Arrhenius R = exp(-Ea/R*T) finding a correlation of r=0.784821. Also the data were adjusted to the Michelis Menten Equation: V=Vmax*(S)/(S)+Km, obtaining a correlation of r = 0.4285.

The model of multiple linear regression allow us to predict the rate of respiration of pepper c. v. poblano at different concentrations of O_2 and CO_2 and at different temperatures and time with a reasonable correlation (r=0.8072 and r = 0.8440). It is possible to observe in Eq. 1 that the temperature has the most important effect in the rate of respiration followed by the interaction of temperature and time. An in decreasing order of importance, interaction of oxygen with time, carbon dioxide with time, the origin of the product and a smaller effect with carbon dioxide and the time. In Figure 1a, is observed that the general behavior of the model is that at greater concentration of O_2 greater rate of respiration (Ec. 1). In the Figure 1b, is observed the mathematical model for the CO_2 production (Ec. 2) where we can see that as oxygen concentration decreases, the rate of respiration also does. In figures 1a and 1b that represents our mathematical model, most of data fall in a rank between 2 and 8 (Raw predicted values), for the consumption of O_2 and the CO_2 production and it is observed that between these values a great dispersion among them is causing a low correlation; in higher ranks (16 - 26 Raw predicted values) the dispersion also decreases reason why the model is correct; the great dispersion obtained, can be avoided by decreasing the number of experiments at low concentrations (Gallegos-Infante, 2001).

Regarding the effect of temperature on respiration rate, the fitting of the rate of respiration to the model of Arrhenius showed a correlation of r= 0.784821, verifying that the rate of respiration of pepper c. v. poblano. follows the behavior of this model at different temperatures. With regard to the enzymatic model of Michaelis Menten, data do not seem to follow this model given the low correlation coefficient obtained (r = 0.4285).

Conclusions. Temperature is the most important factor in respiration rate, followed by oxigen concentration. Studies are being carried out with pepper from the 2002 crop in order to verify the accuracy of the model and to evaluate the possibility of chilling injury of the chile.

Acknowledgements. The support of the National Council of Science and Technology, CONACyT for the development of this work is thanked for.

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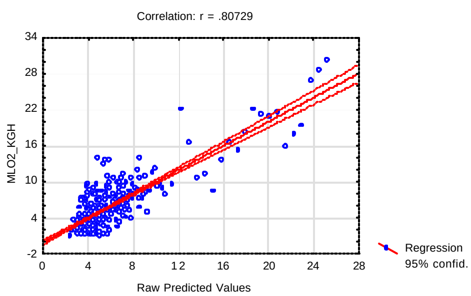
Shiina Takeo, Yamauchi Hiroaki and Haruenkit Ratiporn. 1997. Effects of Temperature and Gas Concentration on the Respiration of Fruits and Vegetables. CA´97. Proceedings Volume 1: Ca Technology and Disinfestation Studies. Edited by James F. Thompson and Elizabeth J. Mitcham.

Table 1. Rate of respiration of green pepper c. v. poblano stored under different gas concentrations and temperature.

$\%O_2$	[1]ml O_2/Kg.h 5°	[2]ml O_2/Kg.h 5°C	$\%CO_2$	[3]ml O_2/Kg.h 0°C	[4]ml O_2/Kg.h 0°C	[2]ml O_2/Kg.h 0°C
5*	1 – 12	1.8 - 9	0	1.5 – 4.5	4 - 8	4 - 8
			5	1 – 4	1 - 7	
			10	1.5 – 3	3 - 7	2 - 8
10*	3 – 14	2.5 - 10	0	1 – 6	2 - 8	2 - 7
			5	1 – 5	1 - 7	
			10	1 – 4.5	1 - 6	2 - 6
15*	4 – 16	3.5 - 11	0			2-6
			10			1-4
21*	6 – 20	5 - 12	0	2 - 5	2.5-8	3.5 - 7
			10			4-10

1. Vicente Guerrero, Dgo.
2. Poanas, Dgo.
3. Sinaloa
4. Zacatecas



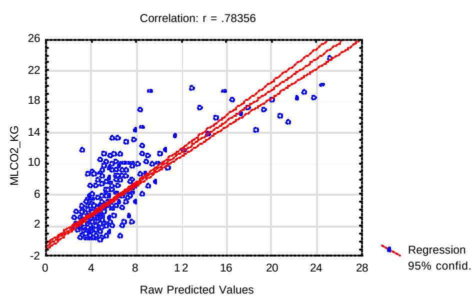


Figure 1. Behavior of the mathematical model in the rate of respiration to different concentrations of oxygen, a) oxygen consumption and b) CO_2 production.

LIMITED IRRIGATION STRATEGIES FOR PEPPER PRODUCTION

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Increased regulations restricting use of underground and surface water resources has placed a large risk on the agriculture sector, and on the livelihood of the farming communities in southwest Texas. Drought and extreme temperatures in the region can cause severe plant stress and fruit physiological disorders reducing marketable yields up to 50%. There is an urgent need to develop water conservation strategies and define optimum irrigation management for vegetable crops. Specialty colored peppers (*Capsicum annuum* L.) are very popular in the Texas markets and consumer demand is increasing rapidly. They bring a higher price than similar-sized green bell peppers. However, most specialty peppers are produced out-of state, thus decreasing the Texas market share. The ultimate goal of this research is to save water, maximize production efficiency, and improve product quality for specialty colored peppers. Field studies are being conducted to examine the effects of irrigation rates applied through subsurface drip (SDI) and Center pivot system. Three irrigation treatments, a well watered level (100% PET) and two limited irrigation rates (80% PET and 60% PET) were applied using either and adjusted crop coefficients (kc) of a kc obtained from FAO. Multiple infrared thermometers (IRT) directly attached to the Center pivot recorder real time canopy temperature to assess plant stress conditions which will be correlated with plant water status. Growth, yield, and fruit quality responses will be discussed. New remote sensing technologies useful to analyze the spatial distribution of biotic and abiotic stress will be presented.

AGRONOMIC EVALUATION OF FOURTEEN BELL PEPPER (*Capsicum annuum*) CULTIVARS IN NUTRIENT FILM CULTURE

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Selection and breeding to adapt the new sweet pepper cultivars to specific growing areas are in progress every year. Nevertheless, these materials must be evaluated properly by institutions and organisms in different agroecosystems in order to recommend their commercial cultivation. This research was carried out at Instituto Tecnológico Agropecuario de Oaxaca, México in a plastic-house compartment measuring 220m^2 and equipped with a natural ventilation system. Sweet pepper seeds were sown in plug trays filled with peat-moss and transplanted into rockwool blocks. Final transplantation took place in a Nutrient Film Technique (NFT) system at a plant density of 3 plants/m^2 for the remainder of the experiment. Fourteen different sweet pepper cultivars were placed in the plastic house according to a completely randomized experimental design. Plant growth parameters were evaluated monthly: plant height, leaves per plant, internode length and percentage of fruit set. Ripe sweet pepper fruits were harvested weekly during nine weeks in order to determine total fruit yield/m^2, fruits/m^2, average fruit weight and percentage of non-marketable fruits. In the twelfth week after the beginning of treatments, there was significant differences in plant height and internode length. Sweet pepper plants from cultivar Ha769 had the highest values for plant height and internode length. Cultivars Pe1208 and Pe1209 had the highest number of leaves per plant. The highest percentage of fruit set was obtained in plants from cultivar HMX0643. After nine weeks of harvest, results for the total fruit yield (kg/m^2) did differ significantly between treatments. Sweet pepper plants from cultivar HMX0640 had the highest fruit yield while plants from cultivar HMX0643 had more fruits per square meter than those plants from the rest of the cultivars. The highest average fruit weight was obtained in fruits harvested from plants of cultivar HMX0645, nevertheless, this cultivar also had the highest percentage of non-marketable fruits. Plants from cultivar Eagle yielded more marketable fruits.

INTEGRACIÓN DE LA RED DE CHILE

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SUMARY

The increase in the production levels of chile (*Capsicum annum*) in the State of Chihuahua, has placed it and the main crop with the best value in production above alfalfa, pecans, apples and any other grain. Associated to this, its great demand in labor as well as its important level of industrialization are the favorable characteristics due to the loss of appreciation of the production alternatives in the agrocultural sector.

The productive dynamics contrasts with a poor and deficient articulation between the different participants of the net, the different efforts in investigation and development, technology transference, search of industrialization alternatives and trade, application of innovating supplies, development of trusthworthy suppliers and according to the needs, etc., are isolated and little impressive.

Due to this, it has special importance in achieving the integration of efforts, giving them orientation towards the solution of problems with total satisfaction of the interested, with significative savings in resources, time and effort, for which significative efforts are required, a great moral comittment and shared responsibility between the precursors of such initiative.

The initial effort has been approved among three industries plus 20 agricultural suppliers, two suppliers, the Facultad de Ciencias Agricolas y Forestales, belonging to the Universidad Autonoma de Chihuahua, the Instituto de Investigaciones Agrícolas y Forestales, Centro de Investiacion de Alimentos y Desarrollo de Delicias and the Trusts Established in Relation to Agriculture (FIRA).

We have initially focused in the technological improvement of the agricultural suppliers in the production of chile with export quality under probiotic and organic production, giving emphasis to the good agricultural practice searching for innocuous food.

The different activities that are developed to promote this project are looking for the attention of all the participants in the net in all levels. This is not a technical trial, being one of the most important achievements, it is about an effort towards ambicious goals in which the industrials (local, regional and national) play an important role so that the rest of the participants in the net achieve profitable conditions with efficiency in the use of resources.