EFFECT OF SPRAYING AMINO ACIDS ON GROWTH AND YIELD OF BITTER GOURD PLANT GENOTYPES *Momordica charantia L.* AND ITS CHARANTIN CONTENT

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ABSTRACT

This Experiment was carried out in the plastic houses , College of Agricultural Engineering Sciences , University of Baghdad during the spring season 2018. Six inbred lines of bitter gourd were crossed full diallel crosses and planted during season 2018-2019 (six inbred lines +15 diallel hybrid + 15 Reciprocal hybrid + control hybrid). These genotypes were studied under the influence of amino acid spraying. This experiment was carried out using the split plot design included two factors: The first factor represents amino acid spraying with control treatment and spraying phenyl alanine amino acid at concentration of 50 mg/L, and spraying Tyrosine amino acid at 100 mg/L with three times during growing season .Represents main plot were distributed randomly on three replicates.The second factor represents 37 genotypes of the bitter gourd represents Sub plot . The results were showed highest that the interaction [T (5 × 4)] had total chlorophyll concentration in leaves (29.11 mg .g^{-1}) , percentage of fruit setting (86.95%), fruit weight (122.6 g). While the interaction P (2×3) had highest charnitin yield in plant (0.857 g). The hybrid(2×3) gave the highest charantine in the plant (0.760 g) .

Key words: Bitter gourd, tyrosin, hybrid, total phenols, phenylalanin
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تأثير الرش بالاحماض الامينية في نمو وحاصل تراكيب وراثية من القرع المر *Momordica charantia L.* ومحتواها من الكارنتين

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المستخلص

نفذت التجربة في البيوت البلاستيكية التابعة لكلية علوم الهندسة الزراعية – جامعة بغداد في ربيع 2018 إذ إدخلت ست سلالات من القرع المر في برنامج التضريب التبادلي الكامل وفي الموسم اللاحق (خريف 2018 –2019) زرعت بذور37 تركيب وراثي (ست سلالات و15 هجين تبادلي و15 هجين عكسي و هجين القياس) إذ درست هذه التراكيب الوراثية تحت تأثير رشها بالاحماض الامينية. نفذت التجربة ضمن تصميم الالواح المنشقة Split plot design وتضمنت التجربة عاملين، العامل الاول يمثل الرش بالاحماض الامينية [الرش بالماء المقطر (معاملة المقارنه) والرش بالحامض الاميني phenyl alanine بتركيز 50 ملغم /لترو الرش بالحامض الاميني Tyrosine بتركيز 100 ملغم / لتر وبمعدل ثلاث مرات في موسم النمو والتي تمثل Main plot وعلى ثلاث مكررات، والعامل الثاني يمثل 37 تركيب وراثي من القرع المرتمثل Sub plot والتي وزعت عشوائياً في كل مكرر. أظهرت النتائج تفوق معاملة التداخل [T(5×4)] في تركيز الكلوروفيل الكلي في الاوراق (29.11 ملغم .غم$^{-1}$) والنسبة المئوية للعقد (86.95%) ووزن الثمرة (122.6غم) وحاصل النبات (2.725 كغم) كما تفوقت معاملة التداخل [P (2×3)] في حاصل الكارنتين في النبات (0.857 غم) وأعطى الهجين (2×3) أعلى حاصل للكارنتين في النبات (0.760غم)

الكلمات المفتاحية: القرع المر، التايروسين، الفنيل الالنين، التهجين، الفينولات الكلية

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INTRODUCTION

Bitter gourd *Momordica charantia L.* is one of the medicinal plants related to Cucurbitaceae family, It is monoecious plant , male and female flowers are distributed separately on the plant (2). It is widely cultivated as food and medicine plants in China, Malaysia, India, Africa , Southeast Asia and South America (9). Bitter gourd occupies an important place in diabetic patients for the characteristics of anti-diabetes . Fruits and seeds are used for treating of blood sugar and can be used antifungal, bacterial and parasitic as well as anti-viruses, especially HIV (5). Recent studies was showed that plant-based antioxidants can be of great importance as therapeutic agents for delaying old signs for human (20). Bitter gourd seeds are used to treat ulcers, liver, spleen problems, diabetes, high cholesterol, wound healing and stomach pain (8). Amino acids are stimulate physiological and biochemical processes in plants, It is involved in building proteins and carbohydrates(15). It is an important amino acid for the plant (Phenylalanine) and essential amino acid that cannot be manufactured in mammals in sufficient quantities to meet protein synthesis requirements (7; 19). Tyrosine is an important aromatic amino acid for protein synthesis in all living organisms.In plants it acts as a base for many specialized metabolites that have diverse physiological roles such as electron carriers, antioxidants, attractants, defense compounds and secondary compounds (14). El-Nemr et al (3) found that eggplant sprayed with amino acids at a concentration of 8 ml. L^{-1} resulted in a significant increase in the yield of the plant compared to spraying with yeast and humic acid. Reham et al. (13) also found that spraying basil with amino acid phenylalanine in concentrations (0, 50 and 100) $mg.L^{-1}$ and nickel in concentrations (0, 50 and 100) mg. It led to a significant increase in vegetative growth characters those were plant length , wet and dry plant weight , leaves weight , flower weight and its content of volatile oil. This study was aimed to increase the yield of fruit and concentration of charantin in fruits by spraying several genotypes of bitter gourd with amino acids.

MATERIALS AND METHODS

This experiment was carried out during spring and fall seasons 2018 - 2019 at the fields of Agricultural Engineering Sciences College, Station B. the field was devided to 5 terraces in 90 cm of width, spaced by 60 cm, with 75 cm on each sides of the plastic house, each terrace contained two planting lines provided with dripping irrigation pipes in 10 cm of each side, the bitter gourd was planted alternately on the terrace and spaced by 50 cm between each plant. All agricultural operations, fertilizations managements were carried out according to the recommendations. In the spring season 2018, the seeds of six inbred lines was planted which symbolized as 1, 2, 3, 4, 5 and 6 and involved into full daillel crosses, to produced seeds of 36 genotypes (Six inbred lines, 15 diallel hybrid and 15 reciprocal hybrid). In the fall season 2018-2019, seeds of 37 genotypes were planted in the plastic houses on 9/5/2018 .Those genotypes were studied under the influence of spraying amino acid This experiment was carried out within Randomized Blook design with split plot arrangement (3 × 37) and included two factors : The first factor represents amino acid spraying (the control treatment called C), spraying phenyl alanine amino acid with concentration of 50 mg/L, called P and spraying Tyrosine amino acid at 100 mg/L called T).Those amino acid were spraying of three times at growing season .The amino acid treatment were represented in the main plots and distributed randomly in each replicate .The genotypes were represented in sub plot, which distributed randomly, Each experimental units included six plants. The studied traits were branches number, leaves area (m^2) , total chlorophyll concentration ($mlg.gm^{-1}$),sexual percent (number of femal flowers / number of male flowers), holding percent (number of flower set /number of femal flowers) , fruit weight (gm) , charantin concentration (mlg 100 gm^{-1}), charintin yield (plant yield gm) × fruits dry weight (%) × Charantin concentration {(mlg/gm) /1000}, and phenols compounds concentration (mlg gm^{-1}) (17) .The resultes were analysed using analysis of variance and the means were compared using L.S.D.0.05.

RESULTS AND DISCUSSION

Results in Table 1 reveal significant differences between the two stadied factors and their interaction in plant branches number , where indicated significant increases of intraction T (6 × 1) and gave the highest value (8.750 branches.plant $^{-1}$) which did not differed significantly from the interaction treatments [(P (2 × 1], [(T (6 × 2] and [(T (5 × 4] ,while the lowest value produced by the interaction treatment [C (2 × 4)] which had 2.00 branches.plant^{-1}. In addition, 17 genotypes exceeded the control hybrid (4,423 branches. plant $^{-1}$). Plants sprayed with amino acid Tyrosin gave the highest number of branches (6.052 branches.plant^{-1}), compared with the control plants, which did not spraied with amino acids ,which gave the lowest value was 3.810 branches.plant^{-1}. Leaf area results as in Table 1 show that the two interaction treatments T (6 × 5) and T (6 × 1) showed most increase in leaf area, which was (1.734 m^2), those gave same significance of T (1 × 5), T (6 × 2), T (5 × 4) and T (6× 4), compared to the lowest leaf area, which was produced from plants of interaction treatment C(3), it was 0.668 m^2. The same table shows the superiority of 25 genotypes compared to the hybrid control (0.964 m^2), and the 6 × 5 hybrid gave its highest value (1.520 m2)), which did not differed significantly from both hybrids 6×1 and 6×2.Spraying amino acid achieved superiority of tyrosine treatement that leaf area obtained 1.265 m^2 compared to control treatment, which obtaiend 0.990 m^2. The results of Table 2 show that the treatment T (5 × 4) had the highest total chlorophyll concentration in the leaves (29.11 mg.g^{-1}), which did not differed significantly from the treatments [(P (5 × 4] and [(T (6). × 5] and [(T (6 × 4] compared to treatment plants [C (4 × 5)], which gave the lowest value of 14.08 mg.g^{-1}. The results also showed that the 5 × 4 hybrid was significantly superiored to all other genotypes, producing the highest total chlorophyll concentration in leaves (28.39 mg. g^{-1}) and 24 genotypes in this trait out weighed the control hybrid (18.00 mg.g^{-1}). In addition, treatment of amino acids significantly affected to chlorophyll concentration like Tyrosine amino acid treatment which gave 22.41 mg. g $^{-1}$ compared to non-treatment plants which achieved 19.65 mg. g $^{-1}$. The potential effect of some amino acids like phenylalanine and tyrosine on vegetative growth characters such as number of branches, leaf area and total chlorophyll concentration, this genetic materials response could be due to the nature of genotypes that have a high susceptibility to amino acid spraying and led to improve plant traits through stimulation of physiological and biochemical processes. These substances contribute to construct many important compounds such as proteins, carbohydrates, purines, alkaloids, vitamins, enzymes and chlorophyll and they catalyze the processes of carbon representation for providing many materials during plant growth (15). The result agreed to the conclusion of Faraj and Jumily (4) on tomato and Noroozlo et al. (12) for lettuce plant and Al-Maamory and Al-bayati(1) on fig plant. The results of Table 3 show that the plants treatment of C (1 × 4) gave the highest value of sexual ratio (0.747) which did not differed significantly of interaction treatment P (1 × 3) compared to the lowest value that was given for T (4). As reveaed superiority of 20 genotypes over control hybrid (0.321), where the hybrid of 1×4 achieved the highest values (0.652) to give significant rising compared of other genotypes, while, hybrid (5 × 4) of spraying Phenylalanine amino acid at concentration of 50 mg / l gave increases of setting percentage reached 86.95% which , did not differed significantly from C (5 × 4), T (4), (T (6 × 4), T (6 × 5), T (6), T (4 × 1) and (P (2 × 1) compared to T (6 × 2),which obtained minimum percentage of setting reached 47.41%. Results in the same Table shows that 26 genotypes exceeded to the control hybrid (56.75%). The hybrid 5 × 4, which gave the highest fruit setting percent (83.45%) and did not differed significantly from the hybrid 6 × 4, which was significantly superiored to the most genotypes. It was found that plants sprayed with amino acid Tyrosin gave the highest fruit setting percent 67.53%, but did not differed significantly from plants that were not spraied with amino acids , both of them significantly superior to plants spraied with amino acid phenylalanine, which gave the lowest percentage 64.91%.The reason for the superiority can be attributed of some genotypes bitter gourd treated with phenylalanine and tyrosine of Sex ratio and fruit setting percent ,Thus, the improvement of vegetative growth indicators,

Table 1. Effect of Bitter gourd genotypes with spraying amino acids and their interaction on branches number (branch.plant^{-1}) and total leaf area (m^2).

	branches number				total leaf area			
genotype	control	Tyrosin(T)	Phenylalanine(P)	mean	control	Tyrosin(T)	Phenylalanine(P)	mean
1	3.750	6.720	5.567	5.346	0.887	1.116	1.002	1.002
2	5.000	7.163	6.25	6.138	1.092	1.401	1.105	1.199
3	2.500	3.693	3.000	3.064	0.668	0.865	0.805	0.779
4	5.250	8.027	7.637	6.971	0.723	1.005	0.952	0.893
5	2.330	4.997	3.500	3.609	0.771	0.975	0.915	0.887
6	4.720	8.553	7.500	6.924	1.106	1.420	1.225	1.250
1×2	3.750	6.500	5.250	5.167	1.080	1.377	1.239	1.232
1×3	3.330	5.833	4.750	4.638	0.894	1.199	1.015	1.036
1×4	4.750	7.303	6.750	6.268	1.172	1.452	1.311	1.312
1×5	4.750	8.220	6.277	6.416	1.066	1.644	1.333	1.348
1×6	6.330	8.750	7.500	7.527	1.063	1.326	1.205	1.198
2×1	5.660	6.833	8.500	6.998	0.961	1.186	1.112	1.086
2×3	3.330	6.443	5.000	4.924	1.011	1.237	1.081	1.109
2×4	2.000	4.610	3.000	3.203	0.901	1.245	1.059	1.068
2×5	2.500	5.277	4.000	3.926	1.091	1.389	1.231	1.237
2×6	2.330	4.943	3.000	3.424	1.151	1.343	1.193	1.229
3×1	2.660	5.083	3.663	3.802	0.889	1.163	1.052	1.035
3×2	2.663	3.220	3.000	2.961	1.178	1.552	1.360	1.363
3×4	3.500	5.386	4.360	4.416	0.831	1.043	0.955	0.943
3×5	2.250	3.083	2.500	2.611	1.008	1.230	1.055	1.098
3×6	2.000	3.693	3.000	2.898	0.724	0.890	0.831	0.815
4×1	2.500	5.053	4.330	3.961	1.056	1.231	1.119	1.135
4×2	2.500	4.860	3.000	3.453	0.920	1.158	0.987	1.021
4×3	3.500	3.777	3.000	3.426	0.675	0.856	0.745	0.758
4×5	6.750	7.833	8.250	7.611	0.731	0.984	0.937	0.884
4×6	2.660	4.220	3.277	3.386	0.914	1.255	1.011	1.060
5×1	4.660	7.330	7.000	6.330	0.716	0.936	0.814	0.822
5×2	5.500	7.667	6.750	6.639	0.901	1.209	1.063	1.057
5×3	3.000	5.853	4.500	4.451	0.827	0.943	0.865	0.878
5×4	3.500	5.220	4.750	4.490	1.191	1.606	1.337	1.378
5×6	4.200	6.860	5.000	5.353	1.045	1.321	1.192	1.186
6×1	6.500	7.720	7.330	7.183	1.267	1.734	1.506	1.502
6×2	4.500	7.803	6.000	6.101	1.292	1.623	1.475	1.463
6×3	2.663	5.750	4.000	4.138	1.238	1.520	1.359	1.372
6×4	5.250	7.163	6.750	6.388	1.251	1.563	1.339	1.384
6×5	4.500	6.803	5.500	5.601	1.327	1.734	1.500	1.520
control	3.330	5.663	4.277	4.423	0.852	1.063	0.977	0.964
mean	3.810	6.052	5.073		0.990	1.265	1.115	
L.S.D	interaction 1.266		Amino acid	genotype	interaction		Amino acid	genotype
0.05			0.393	0.723		0.180	0.166	0.069

Table 2. Effect of Bitter gourd genotypes with spraying amino acids and their interaction on total chlorophyll concentration (mg. g^{-1}).

genotype	Control (C)	Tyrosin(T)	Phenylalanine(P)	mean
1	18.80	23.06	22.65	21.50
2	21.64	25.50	24.05	23.73
3	18.41	22.31	20.61	20.45
4	14.40	17.65	16.08	16.04
5	18.67	20.26	19.40	19.45
6	21.84	25.63	23.70	23.73
1×2	17.06	20.06	19.62	18.91
1×3	23.98	26.86	24.85	25.23
1×4	17.72	20.45	21.44	19.87
1×5	23.80	26.08	25.80	25.23
1×6	18.87	18.67	17.42	18.32
2×1	16.33	18.46	17.33	17.37
2×3	19.51	24.50	23.78	22.60
2×4	20.25	23.95	23.07	22.42
2×5	24.89	26.59	26.89	26.12
2×6	19.86	26.52	25.11	23.83
3×1	23.40	25.81	24.81	24.67
3×2	21.87	24.39	23.06	23.11
3×4	18.09	21.45	20.18	19.91
3×5	17.23	20.15	19.46	18.95
3×6	18.55	20.50	19.27	19.46
4×1	15.99	20.24	18.97	18.40
4×2	18.81	21.52	20.59	20.31
4×3	20.70	21.93	20.99	21.21
4×5	14.08	16.97	14.11	15.05
4×6	17.23	19.62	18.11	18.32
5×1	16.80	19.70	18.97	18.49
5×2	17.20	21.28	20.03	19.50
5×3	15.22	17.03	15.75	16.00
5×4	27.61	29.11	28.46	28.39
5×6	20.20	23.01	21.83	21.68
6×1	17.11	19.83	18.31	18.42
6×2	17.17	19.68	18.36	18.40
6×3	24.62	26.65	26.07	25.78
6×4	25.73	27.67	26.07	26.49
6×5	26.60	28.06	25.50	26.72
CONTROL	16.66	17.99	19.34	18.00
mean	19.65	22.41	21.35	
L.S.D 0.05	Amino acid 1.550		interaction 2.240	Genotype 1.117

Table 3. Effect of bitter gourd plants genotypes with spraying amino acids and their interaction on sexual ratio and setting percentage %

	sexual ratio				%setting percentage			
genotype	control	Tyrosin (T)	Phenylalanine(P)	mean	control	Tyrosin(T)	Phenylalanine(P)	mean
1	0.299	0.332	0.311	0.314	69.89	63.81	61.89	65.19
2	0.343	0.404	0.402	0.383	73.86	77.86	71.81	74.51
3	0.230	0.252	0.292	0.259	77.65	76.40	65.39	73.14
4	0.250	0.195	0.236	0.227	77.24	83.98	66.17	75.80
5	0.412	0.484	0.423	0.441	79.79	74.07	72.20	75.35
6	0.400	0.333	0.442	0.392	61.63	82.09	68.36	70.69
1×2	0.289	0.332	0.361	0.326	79.92	71.54	71.10	74.19
1×3	0.553	0.468	0.711	0.577	68.57	73.00	61.93	67.83
1×4	0.747	0.565	0.644	0.652	63.00	62.30	67.66	64.32
1×5	0.523	0.494	0.491	0.503	55.35	52.38	53.69	53.81
1×6	0.540	0.551	0.555	0.549	61.93	61.51	57.95	60.46
2×1	0.376	0.324	0.304	0.335	74.39	79.04	80.91	78.11
2×3	0.281	0.343	0.305	0.309	67.48	57.94	65.37	63.60
2×4	0.311	0.311	0.306	0.309	58.00	53.76	53.79	55.18
2×5	0.310	0.439	0.385	0.378	55.97	51.79	52.60	53.45
2×6	0.342	0.471	0.454	0.425	62.11	57.55	61.38	60.34
3×1	0.289	0.341	0.272	0.303	57.25	64.66	57.70	59.87
3×2	0.265	0.370	0.319	0.318	62.09	54.09	59.47	58.55
3×4	0.336	0.416	0.304	0.354	58.93	62.33	64.98	62.08
3×5	0.401	0.644	0.505	0.511	74.19	59.50	69.33	67.67
3×6	0.370	0.371	0.363	0.368	63.79	75.62	70.71	70.04
4×1	0.335	0.325	0.320	0.327	74.33	81.16	78.15	77.88
4×2	0.390	0.339	0.369	0.366	55.42	58.65	54.37	56.14
4×3	0.290	0.355	0.284	0.310	65.46	55.93	64.34	61.91
4×5	0.580	0.522	0.504	0.535	65.13	65.75	65.93	65.61
4×6	0.431	0.387	0.387	0.402	62.55	63.49	66.03	64.02
5×1	0.507	0.319	0.422	0.416	61.46	76.27	65.33	67.69
5×2	0.404	0.369	0.457	0.410	62.75	67.55	58.34	62.88
5×3	0.476	0.412	0.446	0.444	68.20	67.91	71.81	69.31
5×4	0.611	0.635	0.525	0.590	85.74	77.64	86.95	83.45
5×6	0.547	0.546	0.549	0.547	72.26	73.78	73.10	73.05
6×1	0.484	0.448	0.487	0.473	53.22	57.90	53.98	55.03
6×2	0.339	0.344	0.392	0.358	62.34	61.89	47.41	57.21
6×3	0.436	0.348	0.327	0.370	68.54	67.95	75.17	70.56
6×4	0.483	0.336	0.387	0.402	78.02	83.40	78.11	79.84
6×5	0.439	0.424	0.497	0.453	78.92	83.06	60.50	74.16
control	0.297	0.274	0.394	0.321	61.49	61.14	47.62	56.75
mean	0.403	0.402	0.413		67.00	67.53	64.91	
L.S.D 0.05	Amino N.S acid		interaction 0.093	Genotype 0.049	Amino acid 1.910	interaction 6.746		genotype 3.868

depends on the nature of genotypes that have high susceptibility and DNA composition to spraying response with amino acids , which reflected positively on improving the physiological and nutritional status of the plant and then the ability of the plant to form male and female flowers. Hybrid (5 × 4) was observed heighest fruit setting percent could be due to its superiority in some vegetative growth traits, especially the total chlorophyll concentration (Table 2). Leaf area (Table 1). This improves their adequacy in the carbon metabolism and consequently the accumulation of dry matter, leading to improvement in the percentage of the contract due to the vailability of sufficient stocks of food. The amino acids stimulate the physiological and biochemical processes in plants by increasing dry matter chlorophyll and stimulating the processes of carbon metabolism (15). The results of Table 4 show that of the plants of the intraction (6 × 4) T) produce at the highest fruit weight (122.6 g), which did not significantly differed from the interaction [P (6 × 4)] and [T (6 × 3)] as measured by the lowest value by the treatment [C (5 × 2)] (46.33 g), Twenty-five genotypes were superiored to the control hybrid (79.27). The hybrid 6 × 4 gave the highest values (119 g) and significantly differed from other genotypes. Also, It was revealed by the superiority of plants sprayed with amino acid Tyrosine by producing the highest value of fruit weight , which reached 89.74 g compared to the control treatment (81.48g) . In plant yield, it is clear that the plants of the treatment [T (5 × 4)] produced the highest plant yield (2.725 kg) and superior significantly on all the other treatments compared to the lowest value by the treatment [C (5 × 2)] (0.577 kg). Also,it was exceeded 26 genotypes to the control hybrid, the hybrid 5 × 4 gave the highest plant yield (2,300 kg). Also , it was shown that plants treated with the amino acid tyrosine gave the highest value per plant yield(1.534 kg). Perhaps the reason for the increase in yield characters (fruit weight and plant yield),To the positive role of amino acids in stimulating physiological and biochemical processes in plants, It is involved in the construction of many important compounds, including chlorophyll, which leads to increased carbonization processes and thus provide sufficient food to increase the weight of the fruit (15). Besides their use in the biosynthesis of protein, they are involved in the construction of many biosynthesis pathways (6).

Table 4. Effect of bitter gourd plants genotypes with spraying amino acids and their interaction on fruit weight and one plant yield (kg)

	fruit weight				plant yield			
genotype	control	Tyrosine (T)	Phenylalanine(P)	mean	control	Tyrosine(T)	Phenylalanine(P)	mean
1	90.11	82.83	89.44	87.46	1.012	0.971	1.018	1.000
2	97.44	106.83	99.66	101.3	1.466	1.447	1.815	1.576
3	83.77	92.73	87.41	87.97	0.802	1.140	1.051	0.997
4	72.66	81.11	76.18	76.65	0.686	0.886	0.774	0.782
5	52.75	60.00	56.88	56.54	0.924	1.161	1.047	1.044
6	63.16	67.10	65.40	65.22	0.954	1.042	1.002	0.999
1×2	95.33	107.8	99.30	100.8	1.242	1.658	1.505	1.468
1×3	81.26	91.63	86.61	86.50	1.652	2.262	2.106	2.007
1×4	87.66	94.10	89.83	90.53	2.032	2.275	2.102	2.136
1×5	48.94	65.60	60.05	58.19	0.748	1.284	1.049	1.027
1×6	81.00	91.30	86.04	86.11	1.415	1.772	1.590	1.592
2×1	91.66	97.43	94.00	94.36	1.320	1.499	1.384	1.401
2×3	105.5	114.5	108.5	109.5	1.317	1.552	1.437	1.435
2×4	84.07	92.96	88.05	88.36	0.699	0.926	0.820	0.815
2×5	73.49	83.46	80.02	78.99	0.839	1.317	1.156	1.104
2×6	89.00	96.23	91.72	92.31	1.268	1.754	1.641	1.554
3×1	87.16	94.66	89.44	90.42	0.818	1.365	0.937	1.040
3×2	89.66	90.40	91.07	90.38	0.973	1.279	1.241	1.164
3×4	87.94	93.56	91.77	91.09	1.090	1.529	1.324	1.314
3×5	87.55	94.30	90.86	90.90	1.697	2.218	2.027	1.980
3×6	86.50	96.50	89.00	90.66	1.061	1.528	1.350	1.313
4×1	80.30	90.24	85.33	85.29	1.151	1.384	1.288	1.274
4×2	86.16	94.71	89.33	90.07	0.980	1.161	0.998	1.046
4×3	89.66	99.36	92.91	93.98	0.930	1.160	0.967	1.018
4×5	62.00	67.66	67.77	65.81	1.143	1.319	1.305	1.255
4×6	89.50	98.66	94.74	94.30	1.194	1.527	1.400	1.373
5×1	65.33	76.93	70.80	71.02	0.874	1.157	1.005	1.012
5×2	46.33	56.72	49.40	50.81	0.577	0.893	0.761	0.744
5×3	89.66	105.9	94.22	96.60	1.571	1.941	1.720	1.744
5×4	68.77	79.26	73.14	73.72	2.005	2.725	2.172	2.300
5×6	68.33	77.34	71.66	72.44	1.413	1.970	1.758	1.714
6×1	53.16	64.33	59.33	58.94	0.768	1.120	1.026	0.971
6×2	99.33	109.8	101.77	103.6	1.246	1.438	1.242	1.308
6×3	97.99	117.3	102.38	105.9	1.420	1.805	1.565	1.596
6×4	115.66	122.6	118.6	119.0	2.102	2.305	2.167	2.191
6×5	89.83	95.46	91.31	92.20	1.710	2.117	1.765	1.864
CONTROL	73.66	86.00	78.16	79.27	0.768	1.044	0.895	0.902
mean	81.42	89.74	84.79		1.190	1.534	1.363	
L.S.D 0.05	Amin acid 0.676	interaction 6.338		genotype 3.699	Amino acid 0.079	interaction 0.242		Genotype 0.137

Amino acids have essential role for nitrogen and hormones synthesis (10), perhaps due to diversity of plant genotypes compounds and its responding through spraying amino acids, therefore found some genotypes like 5×4 and 6×4 succeed to improve fruit weight , yield and total chlorophyll concentration (Table 2) .The increase of leaf area (Table 1), The genotype mentioned had positive affect number of female flowers, produce enough pollens and enhance conditions of flower setting which lead to a raise in setting percentage then plant yield (Table 3). This study was confirmed the results of El-Nemr et al. (3) in Eggplant plant. Results in Table 5 reveal that the treatment of P(2×3) gave the highest concentration of charantin in fruits (646.3 mg. 100 g $^{-1}$), outperforming all other factors compared to the interaction[(3 × 4) C] which gave the lowest concentration of charantin (5.333 mg) . There were 14 genotypes out performed compared control hybrid, where 2×3 hybrid gave maximum values 579.7 mg. 100g^{-1} highest than other treatments followed parent 4 and hybrid of 1×2. In addition, Phenylalanine amino acid treatment achieved maximum value of the same trait reached 271.2 mg.100g^{-1} compared control treatment that obtained lowest concentration 193.5 mg.100g^{-1}. Results also found the treatment of T(1×3) gave the highest concentration of total phenols in fruits attained 7.31 mg.g^{-1}, while the lowest concentration was observed through C (3) which was 2.34 mg. g^{-1}. Also hybrid 1×3 recorded the highest value compared to all other genotypes, which obtained 6.378 mg. g^{-1}. So, there were rising of 20 genotypes which exceeded control hybrid (5.116 mg. g^{-1}). Tyrosine amino acid treatment provided 6.183 mg.g^{-1} compared to control treatment where obtained the lowest concentration of 4.550 mg. g^{-1}. The increases of some substance such as charantin and total phenols concentration may be due to cinamic acid presence that it contribute through biochemical processes to produce other compounds like phenols and considerable material for processing of many medical

Table 5 Effect of bitter gourd plants genotypes with spraying amino acids and their interaction on charantin concentration (mg.100g^{-1}) and phenols compounds concentration (mg. g^{-1}).

	charintin concentration				phenols compounds concentration			
genotyoe	control	Tyrosin(T)	Phenylalanine(P)	mean	control	Tyrosin(T)	Phenylalanine(P)	mean
1	28.93	37.32	51.47	39.24	3.910	5.550	4.400	4.618
2	163.6	188.71	203.5	185.2	4.310	5.950	4.800	5.018
3	11.40	37.72	47.61	32.24	2.340	3.980	2.830	3.048
4	463.1	586.5	603.1	550.9	4.34	5.980	4.830	5.048
5	44.01	61.23	70.33	58.52	4.71	6.350	5.200	5.418
6	42.43	70.50	155.5	89.48	4.26	5.900	4.750	4.968
1×2	296.8	390.7	435.1	374.2	4.61	6.250	5.100	5.318
1×3	48.33	74.38	175.8	99.51	5.67	7.310	6.160	6.378
1×4	158.8	184.4	328.6	223.9	4.120	5.760	4.610	4.828
1×5	162.1	230.8	377.0	256.6	4.610	6.250	5.100	5.318
1×6	153.5	185.2	170.6	169.8	5.010	6.650	5.500	5.718
2×1	477.3	590.4	556.6	541.4	5.010	6.710	5.560	5.778
2×3	524.0	569.0	646.3	579.7	5.110	6.750	5.600	5.818
2×4	231.6	242.3	316.0	263.3	4.260	5.900	4.750	4.968
2×5	202.9	228.8	241.3	224.3	5.120	6.760	5.610	5.828
2×6	354.9	391.3	463.3	403.2	4.090	5.730	4.580	4.798
3×1	34.19	47.79	75.45	52.47	4.910	6.550	5.400	5.618
3×2	13.29	30.40	50.67	31.45	5.160	6.800	5.650	5.868
3×4	5.333	6.806	8.050	6.730	5.260	6.900	5.750	5.968
3×5	46.18	71.52	71.19	62.96	4.310	5.950	4.800	5.018
3×6	314.6	411.1	444.7	390.1	4.380	6.020	4.870	5.088
4×1	466.0	485.1	502.1	484.4	3.910	5.550	4.400	4.618
4×2	392.6	423.3	531.0	449.0	5.210	6.850	5.700	5.918
4×3	272.3	324.4	346.3	314.3	4.760	6.400	5.250	5.468
4×5	216.3	318.1	371.3	301.9	4.110	5.750	4.600	4.818
4×6	343.9	461.3	591.5	465.5	3.720	5.360	4.210	4.428
5×1	130.3	148.0	174.7	151.0	4.160	5.800	4.650	4.868
5×2	253.6	292.3	281.2	275.7	4.810	6.450	5.300	5.518
5×3	49.27	59.06	74.19	60.84	5.010	6.650	5.500	5.718
5×4	121.0	134.1	140.4	131.8	3.910	5.550	4.400	4.618
5×6	24.50	49.37	55.07	42.98	3.910	5.550	4.400	4.618
6×1	120.3	132.05	141.1	131.1	5.010	6.650	5.500	5.718
6×2	411.8	463.1	517.3	464.1	4.910	6.550	5.400	5.618
6×3	136.2	308.4	281.0	241.9	4.910	6.550	5.400	5.618
6×4	108.2	112.2	127.63	116.0	5.010	6.650	4.500	5.385
6×5	98.21	110.2	122.64	110.3	5.110	6.750	5.600	5.818
CONTROL	240.0	268.8	286.4	265.1	4.370	6.066	4.916	5.116
mean	193.5	235.8	271.2		4.550	6.183	5.015	
L.S.D 0.05	Amino acid 8.328	interaction 13.72		genotype 7.171	Amino acid 0.188	Interaction 0.246	Genotype 0.117	

substances, it is also derived from phenylalanine and tyrosine acid . The results were consistent of other studies like Reham et al. (13), Shukri and Abbas (16) for basil plant. Mohammed and Zarfi (11) for datura plant. The results of Table 6 show that the plants of interaction [P 2 × 3] gave the highest value in total charantine yield (0.857 g), which did not significantly differed from treatment 2 × 3 which gave a value of 0.760 g , while by the lowest value had by the interaction C (3 × 4), which was in the moral 0.004 g, and 13 genotypes surpassed control hybrid (0.188 g). Hybrid 6 × 2 gave the highest values (0.610 g) followed by the moral 2 × 3 and 2 × 1 hybrids, It also shows the superiority of plants treated with histidine phenylalanine by produce the highest value(0.243 g). Charantin yield is the essential main target of many plants breeder and for those interested in medicinal plants, The final outcome of three important trait is the plant's yield of fruits and the concentration of charantine in the fruits and dry matter for fruits ,Which revealed the superiority [p (2 × 3)] and [T(2 × 3)] by giving them the highest charantin yield due to their average values in the fruit product (Table 4),and good results in charantin concentration (Table 5) . The percentage of dry matter. Also genotypes differed in their response to amino acids and their impact on various measured characters. It is noticed that there is a hybrid that gave the highest values in the plant charantin yield and at the same time the values of the concentration of charantin in its fruits are low. It can be concluded from the above results genotypes (inbred lines and hybrids) that differed in their response to amino acid treatments, such as tyrosine and phenylalanine.

Table 6. Effect of bitter gourd plants genotypes with spraying amino acids and their interaction on plant yield of charantine concentration (g)

genotype	Control(C)	Tyrosin(T)	Phenylalanine(P)	Mean
1	0.021	0.030	0.041	0.031
2	0.171	0.218	0.306	0.232
3	0.006	0.032	0.038	0.025
4	0.234	0.400	0.393	0.343
5	0.024	0.044	0.047	0.038
6	0.033	0.069	0.144	0.082
1×2	0.308	0.458	0.588	0.481
1×3	0.058	0.126	0.282	0.155
1×4	0.266	0.365	0.617	0.416
1×5	0.076	0.195	0.273	0.181
1×6	0.144	0.221	0.189	0.185
2×1	0.483	0.667	0.615	0.588
2×3	0.616	0.805	0.857	0.760
2×4	0.108	0.158	0.188	0.151
2×5	0.108	0.175	0.154	0.146
2×6	0.332	0.522	0.595	0.483
3×1	0.018	0.043	0.048	0.036
3×2	0.009	0.029	0.047	0.028
3×4	0.004	0.008	0.008	0.006
3×5	0.064	0.133	0.123	0.106
3×6	0.256	0.486	0.479	0.407
4×1	0.398	0.504	0.505	0.469
4×2	0.280	0.363	0.401	0.438
4×3	0.193	0.294	0.270	0.252
4×5	0.162	0.280	0.333	0.258
4×6	0.256	0.458	0.550	0.421
5×1	0.081	0.125	0.132	0.113
5×2	0.091	0.168	0.142	0.134
5×3	0.058	0.087	0.101	0.082
5×4	0.184	0.288	0.243	0.238
5×6	0.026	0.076	0.077	0.060
6×1	0.065	0.119	0.123	0.103
6×2	0.445	0.592	0.591	0.543
6×3	0.157	0.477	0.382	0.339
6×4	0.262	0.317	0.344	0.308
6×5	0.150	0.222	0.207	0.193
CONTROL	0.124	0.208	0.194	0.175
mean	0.169	0.266	0.287	
L.S.D 0.05		Amino acid 0.029	interaction 0.038	Genotype 0.018

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