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Evaluation effects of cultivar, plant density and weed control on weight of weed in farm of faba bean in climatic conditions of Khuzestan

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Abstract: In order to study the effects of plant density and cultivar on weed control in faba bean fields in climatic conditions of Shushtar, an experiment was conducted in Mian-Ab Region of Shushtar, 13 km, Shushtar-Ahwaz Road, for one year in agricultural year of 2011-2019. In this experiment a complete randomized block design in a factorial-split arrangement with four repititions was used, in which faba bean cultivar was considered at three levels (Barakat, V1; Saraziri, V2; and Mahalli, V3), density at three levels (7, 11 and 14 plants per square meter; D1, D2 and D3 respectively), and weed population of %0, %50 and %100 (R3, R2 and R1 respectively).

Key words: *Faba bean; Cultivars; Plant density; Weed control percentage; Narrow leaf; Broad leaf*

1. Introduction

Ideal plant density is one by which all environmental factors (water, air, sunlight, and soil) are completely used while intra- and extra-plant completion is at the minimum level so that the maximum yield can be achieved with a desirable quality. Alternatively, that density must provide adequate space for maintenance and harvest operations (Khajeh-pour, 2008; Sharifi-zadeh et al., 2012). Mathew et al., (2008) believe that plant density is the most determining factor for plant growth and dry mater accumulation. Ideal density depends on various factors the most important of which are: plants properties, vegetative duration, date and method of planting, soils productivity, plant size, available humidity, solar radiation, planting pattern and weed condition (shirtlif and Johanson, 2002). Castro Coelho and Aguiarpinto (1989) observed that in lower densities of cultivation, dry matter accumulation in pod, stem and leaf was more than that in pod, stem and leaf in higher densities of cultivation in equal days after planting; moreover, increase in dry weight was more in pod rather than stem and leaf and that rate of matter accumulation in this organ heightened as pod started to fill, due to fact that pod was a strong target. In studying 8 planting densities from 7 to 91 plants per square meter, index harvest in vetch decreased as density levels increased; however, no significant different was observed in seed weight of soya. It seems that a plant adjusts its final size to the environment which from the beginning exhibits its prominence by primarily changing the number of pods per plant (Lemma et al., 2009). Also, in studying three distances on rows of faba bean with 10,20 and 30 cm in densities of 14.2 , 7.1 and 4.7 plants per square meter respectively it was determined that increase in distance on rows caused pod number per plant, primary stem and, thus, seed yield to heighten (Idris,2008). Actually, improvement and breeding management of faba bean can be planned more accurately in the future by evaluating and analyzing and agricultural traits, especially traits effective in faba bean yield. Not much research has so far been performed to investigate the agricultural techniques used for faba bean in Khuzestan Province. Therefore, conducting some research of this kind can help the increase in faba bean yield in the Province.

2. Materials and methods

This experiment was conducted in field located on 13th km, Shushtar-Ahwaz Road, for one year in agricultural year of 2010-2011. This field with a height of 67 m above sea level and 32º 3′ north latitude and 48º 50′ east longitude is locate in the southwestern part of Iran. On the whole, all the south coastal lands of the country whose height is less than 100 meters have desert climate. Therefore, whole the plain of Khuzestan to the feet of Lodestones Mountains has the properties of this kind of climate. There is an intense warm all over this region (the absolute maximum temperature recorded for this region is 53º related to Ahwaz). Average rainfall in this region is low and at the same time irregular. All the rainfall almost happens in winter, and 7 months of the year lacks rainfall (kuchaki et al., 1995).

This experiment used a complete randomized block density in a factorial-split arrangement with four repetitions in which cultivar of faba bean was considered at three levels (Barakat, V1; Saraziri, V2; Mahalli, V3), density at three levels (7, 11, and 14 plants per square meter; D3, D2 and D1 respectively) and population of weed of %0, %50 and %100 R1,

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R2 and R3 respectively). For weed which was considered at three levels of %0, %50 and %100, R1, R2 and R3 respectively, at %0 level weeds were removed until the end of growth period. At % 50 levels, 50 percent of weeds were controlled. Their control was performed in the manner of removing them from between 1 and 2, 3 and 4, and 5 and 6 lines. From the time of growth of weeds fighting against them started and continued until the end of plant growth such that weeds on the one side of the hill were removed and weeds on the other side were not. In other words, weeds of one ditch were removed and weeds of the next one were not (weed control of every other ditch). At level R3, weeds existed until the end of growth period. Final harvest was performed at time of ripeness from line 4. The entire length of line (6m long) was harvested by using method after removing upper and downer 0.5-mere margins. Obtained data were inserted into tables of spreadsheet of Excel after conclusion and classification. Raw data were variance analyzed by SAS statistical program, and means comparison was performed using Duncan test method. Diagrams were depicted by using Excel Software.

3. Results and discussion

Table 1: Analysis of variance (mean squares) weight of weed weight of narrow leaf weed

S.O.V	df	mean squares					
		Weight of narrow leaf-1	Weight of broad leaf-1	Total-1	Weight of narrow leaf-2	Weight of broad leaf-2	Total-2
R	3	91/6193*	^{ns}71/4851	316/4630*	^{ns}259/1091	^{ns}354/3369	^{ns}485/4382
Cultivar	2	^{ns}9/1988	^{ns}66/0550	^{ns}124/1814	^{ns}67/6267	^{ns}157/9426	^{ns}47/0514
Cultivar × R	6	12/1006	198/1553	149/3401	163/9229	279/5732	1071/1839
Density	2	^{ns}32/3402	^{ns}240/3240	^{ns}403/5094	^{ns}11/1629	1859/0239*	^{ns}1402/3922
weed control	2	327/0185**	2780/0341**	500/1106**	1934/6336**	16582/6480**	30341/5087**
Density × Cultivar	4	^{ns}2/8528	^{ns}37/4941	^{ns}54/0684	^{ns}72/4509	^{ns}215/5221	^{ns}307/4816
weed control × Cultivar	4	^{ns}4/2980	26/5974*	47/8232*	73/6714*	354/0427*	37/5597*
weed control × Density	4	^{ns}25/1690	92/8016*	136/5342*	^{ns}13/9709	1523/7063*	2161/5846**
Cultivar × Density × weed control	8	^{ns}17/2792	^{ns}57/7515	71/8480*	^{ns}86/9908	824/0688*	967/8603**
Error	72	32/3017	111/7425	114/65	184/0381	471/0911	491/0958
CV (%)	-	58/43	102/93	77/27	131/60	88/40	70/70

ns: non significant, * , **: respectively significant (p≤0.05) and highly significant (p≤0.01)

Table 2: Analysis of variance (mean squares) weight of weed weight of narrow leaf weed

S.O.V	df	mean squares					
		Weight of narrow leaf-3	***Weight of broad leaf-3***	***Total-3***	***Weight of narrow leaf-4***	***Weight of broad leaf-4***	***Total-4***
R	3	963/7099 ^{ns}	1360/5809 ^{ns}	1418/4414 ^{ns}	88/6002 ^{ns}	9936/7620 ^{ns}	8663/2918 ^{ns}
Cultivar	2	670/9108 ^{ns}	103/0434 ^{ns}	1049/2904 ^{ns}	125/0276 ^{ns}	13796/5094 ^{ns}	11764/0852 ^{ns}
Cultivar× R	6	529/6846	876/7655	1755/9310	710/7410	12279/8957	12719/1469
Density	2	3/4360 ^{ns}	2672/6614*	2654/5048 ^{ns}	^{ns} 1299/3296	13301/5887 ^{ns}	14381/6306 ^{ns}
weed control	2	3155/5919**	34388/4156**	56913/8372**	2267/9101*	237083/9108**	284542/5197**
Density × Cultivar	4	243/4484 ^{ns}	1191/8645*	410/6193 ^{ns}	470/0258 ^{ns}	6724/1769 ^{ns}	8889/5229 ^{ns}
weed control × Cultivar	4	482/7067 ^{ns}	1516/6383*	885/5872*	757/6526 ^{ns}	4732/7364*	5661/0521*
weed control × Density	4	^{ns} 1040/2655	1246/6508*	2498/8492**	^{ns} 2016/2474	19972/0170**	14441/9906*
Cultivar× Density × weed control	8	363/3320 ^{ns}	1348/0796**	1926/0519**	365/7323 ^{ns}	4241/4251*	4028/9223*
Error	72	547/9836	703/8348	1142/4299	689/1144	7404/7740	7141/0910
CV (%)	-	54/19	74/33	75/28	88/52	91/69	82/0827

ns: non significant, * , **: respectively significant (p≤0.05) and highly significant (p≤0.01)

3.1. Weight of weed

Weight of narrow leaf weed

The analysis of variance showed weight of narrow leaf weeds on five sampling stages was not affected by the cultivar and density. In addition, this attitude on five sampling stages was significantly affected by different levels of weed removal (Tables 1,2,3). The mean comparisons of main effects

showed that the highest weight of narrow leaf weeds on five sampling stages was obtained under condition without weed control. The interaction of cultivars and plant density on five sampling stages hasn't significant effect on weight of narrow leaf weeds (Tables 1,2,3). The mean comparisons of interaction showed that the weight of narrow leaf weed only the second stage was affected interaction of cultivars with weed removal (Tables 1,2,3). So that the highest weight of narrow leaf weed on second stage was obtained a mean 17.53 gr/ m2 in Barakat cultivar under condition without weed control. The weight of narrow leaf weed on five sampling stages isn't affected by interaction of plant density and weed removal and triple interaction of cultivars, plant density and weed removal (Tables 1,2,3). At high densities due to population of plant is provided lower growth opportunity for weeds to weeds that is resulted to its sparseness of weeds. The similar results have been reported about effect of plant density on weight of dried weed (Azimkhan and Morouvat, 2006 and Christensen et al, 2008).

3.2. Weight of broadleaf weeds

The analysis of variance showed the weight of broadleaf weeds on five sampling stages isn't affected by cultivar (Tables 1,2,3). This attitude on the first, fourth and fifth sampling stages isn't affected by plant density, although on the second and third sampling stages is significantly affected by plant density. The mean comparisons of the main effects revealed on the second and third stages, the highest weight of broadleaf weeds on density of 14 plants per square meter was obtained with means of 31.91 and 46.16 grams per square meter, respectively. Also the results showed that the weight of broadleaf weeds on five sampling stages has been significantly affected by different levels of weeds removal (Tables 1,2,3). So that mean comparisons of the main effects showed that the highest weight of broadleaf weeds on five sampling stages was obtained under condition without weed control. The weight of broadleaf weeds only the third sampling stage is affected by interaction of cultivar and plant density. So that the mean comparisons showed that the highest weight of broadleaf weeds was observed in Saraziri cultivar under condition with density of 14 plants per square meter.

This attitude on five sampling stages is significantly affected by the interaction of cultivar and weed removal at the 5% level of significance, statistically. The mean comparisons showed that the highest weight of broadleaf weeds on the first, second, fourth and fifth stages under condition without weed control and about the Saraziri cultivar, the means were obtained 18.87, 48.13, 170.93 and 274.13 gr/ m2, respectively, and on the third stage under condition without weed control and about local cultivar, the mea was obtained 74.89 gr/ m2. The weight of broadleaf weeds on five sampling stages is affected by the interaction of plant density and weed removal. The mean comparisons of interaction showed that the highest weight of broadleaf weed on the first, second and fifth, the means were obtained 21.79, 49.97 and 321.63 gr/ m2, respectively, under condition without weed control and density of 14 plant per square meter and on the third and second stages, the means were obtained 68.04, 207.84 gr/ m2 under condition with 50% weed removal and density of 14 plant per square meter.

Table 3: Analysis of variance (mean squares) Weight of weed Weight of narrow leaf weed

S.O.V	df	Mean Squares		
		Weight of narrow leaf-5	Weight of broad leaf-5	Total-5
R	3	2744/1935 ^{ns}	14767/8870 ^{ns}	5829/1270 ^{ns}
Cultivar	2	540/0593 ^{ns}	7245/9580 ^{ns}	9955/3310 ^{ns}
Cultivar× R	6	9294/3706	6732/8830	12936/9250
Density	2	2202/2179 ^{ns}	27144/4190 ^{ns}	28711/9390 ^{ns}
weed control	2	27826/4991 **	580649/3780 **	859176/2910 **
Density × Cultivar	4	4561/7788 ^{ns}	2534/6890 ^{ns}	9251/6830 ^{ns}
weed control × Cultivar	4	2007/7142 ^{ns}	27353/3880 *	16470/6840 **
weed control × Density	4	3261/1663 ^{ns}	13898/4110 *	26187/4610 *
Cultivar× Density× weed control	8	1928/3429 ^{ns}	11402/5400 **	10815/6890 **
Error	72	4899/7127	8545/9240	7724/0810
CV (%)	-	118/09	64/36	50/01

ns: non significant, *, **: respectively significant ($p \leq 0.05$) and highly significant ($p \leq 0.01$)

The weight of broadleaf weed isn't significantly affected by triple interaction of cultivar, plant density and weed removal only on first sampling stage and on other sampling stages is affected by triple interaction (Tables 1,2,3). Figure 1 show that the highest weight of broadleaf weed on the second stage under condition without weed control and density of 14 plants per square meter, was obtained on Barakat cultivar and the lowest weight of broadleaf weed was obtained on local cultivar under condition with 50% weed removal and density of 7 plants per square meter. This means that local

cultivar at lower densities on this sampling stage could compete better than the other cultivars and control broadleaf weeds.

Figure 2 shows that the highest weight of broadleaf weed on third stage was obtained under condition without weed control, density of 7 plants per square meter and at local cultivar. On this stage, the local cultivar at lower density is superior to the other cultivars under condition with 50% weeds removal. Figure 3 shows that the highest weight of broadleaf weed on fourth stage was obtained under condition with 50% weed removal, density of 14 plants per square meter and at Saraziri cultivar. Figure 4 shows that the highest weight of broadleaf weed on fifth stage was obtained under condition with 50% weed removal, density of 11 plants per square meter and at local cultivar. Also this figure show that at this stage, the final stage of faba bean growth, local cultivar in higher densities couldn't compete with weeds under condition with 50% weed removal and had its power of control is lower than the others. Similar results have been reported by Chahudhary et al (2008) and Bukun (2004).

3.3. The total weight of and narrow leaf and broadleaf weeds

The analysis of variance showed that the total weight of narrow leaf and broadleaf weeds on five sampling stages were not affected by cultivar and plant density (Tables 1,2,3). The total weight of broadleaf and narrow leaf weeds on five sampling stages was significantly affected by weed removal (Tables 1,2,3). So that the highest weight of narrow leaf and broad leaf weeds on five sampling stages, the means were obtained 22.21, 57.68, 78.07, 159.58 and 299.91 gr/ m2, respectively, under condition without control. The total weight of broadleaf and narrow leaf weed on all sampling stages isn't affected by interaction of cultivar and plant density. Also, this attitude on five sampling stages is significantly affected by interaction of cultivar and weed removal (Tables 1,2,3). The mean comparison of interaction showed the highest weight of broadleaf and narrow leaf weed on the first and fifth stages under condition without weed control and at Saraziri cultivar, the means were obtained 60.24 and 320.10 gr/ m2 and the second stage under condition without weed control and at Barakat cultivar, the means was obtained 60.24 gr/ m2and on third stage under condition without weed control and at local cultivar, the mean was obtained 93.29 gr/ m2 and the fourth stage under condition with 50% weed removal and at Saraziri cultivar, the means was obtained 184.13 gr/ m2.

The total weight of broadleaf and narrow leaf weed on all sampling stages is affected by interaction of plant density and weed removal (Tables 1,2,3). The mean comparison of interaction showed the highest weight of broadleaf and narrow leaf weed on the first, second, third and fifth stages under condition without weed control and density of 14 plants per square meter, the means were obtained 27.54, 65.58, 89.15 and 321.63 gr/ m2; but the fourth stage, the highest weight of narrow leaf and broadleaf weeds under condition with 50% weed removal and density of 14 plants per square meter, the mean was obtained 210.53 gr/ m2.

The triple interaction of cultivar, plant density and weed removal were significantly affected on weight of narrow leaf and broadleaf weeds on five sampling stages (Tables 1,2,3). The figure of 5 show the highest weight of broadleaf and narrow leaf weeds on first sampling stage was obtained under condition without weed control and density of 11 plants per square meter and at Saraziri cultivar. Under condition with 50% weed removal, Barakat cultivar at density of 7 plants per square meter was superior to weed control and the local cultivar at middle density (11 plants per m2) was superior to weed control; but at density of 14 plants per square meter, there wasn't significant difference between cultivars.

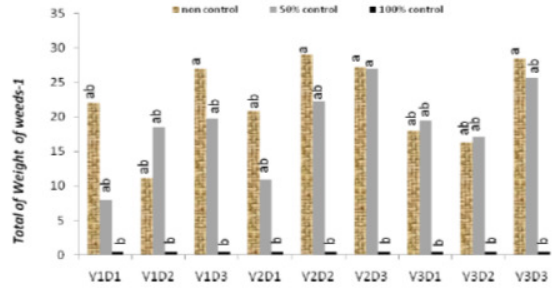

Fig. 1: Effect of density, weed control and Cultivar in Total Weight of broadleaf and of narrow leaf -1

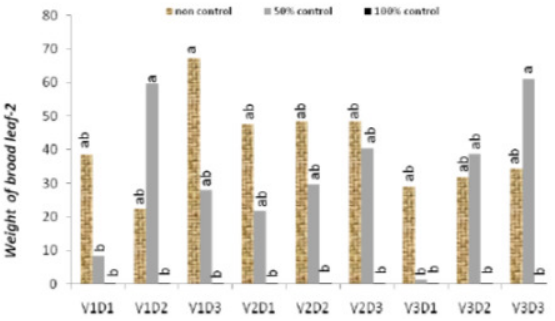

Fig. 2: Effect of density, weed control and Cultivar in Weight of broadleaf leaf-2

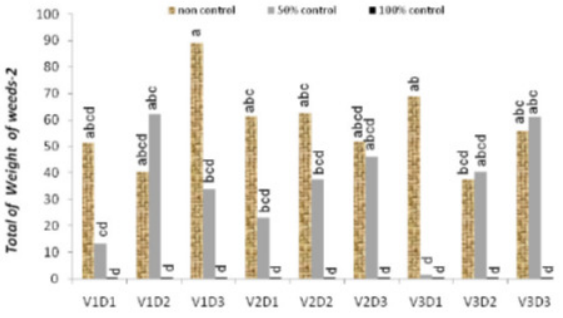

Fig. 3: Effect of density, weed control and Cultivar in Total Weight of broadleaf and of narrow leaf -2

Figure 6 shows that the highest weight of narrow leaf and broadleaf weed on second sampling stage

was obtained under condition without weed control, density of 14 plants per square meter and at local cultivar. On this stage, the local cultivar at density of 7 plants per square meter could compete with weeds under condition with 50% weeds removal and control them and show its superiority to the other cultivars.

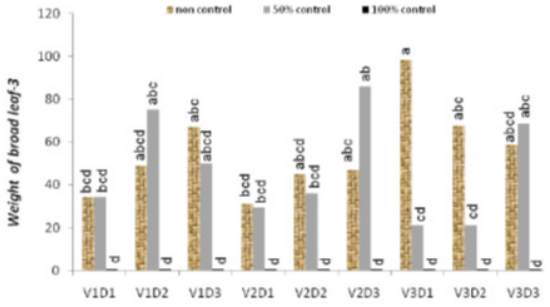

Fig. 4: Effect of density, weed control and Cultivar in Weight of broadleaf leaf-3

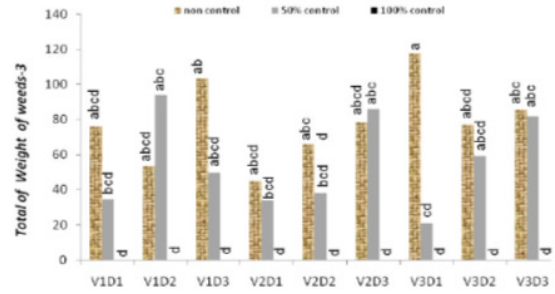

Fig. 5: Effect of density, weed control and Cultivar in Total Weight of broadleaf and of narrow leaf -3

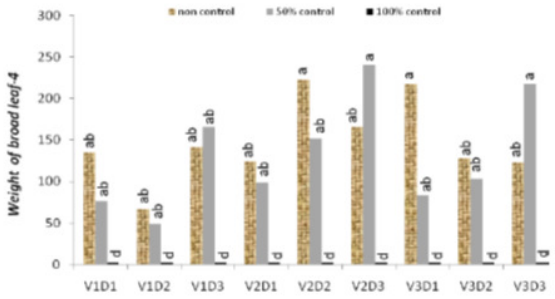

Fig. 6: Effect of density, weed control and Cultivar in Weight of broadleaf leaf-4

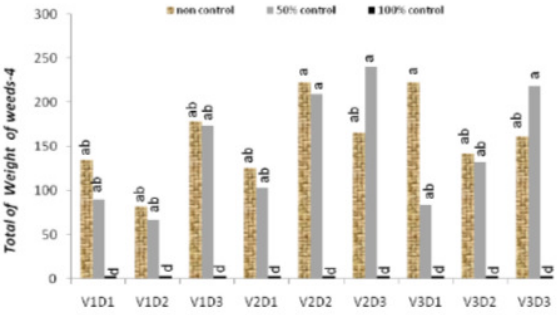

Fig. 7: Effect of density, weed control and Cultivar in Total Weight of broadleaf and of narrow leaf -4

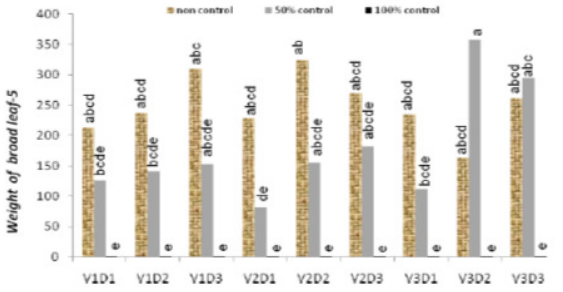

Fig. 8: Effect of density, weed control and Cultivar in Weight of broadleaf leaf-5

The highest weight of broadleaf and narrow leaf weeds on third stage was obtained under condition of without weed control in the local cultivar and density of 7 plants per square meter. The lowest weight of narrow leaf and broadleaf weeds, also, was obtained under conditions with density of 7 plants per square meter and 50% weed removal and at the local cultivar. This means the local cultivar on fourth stage under control better than the other cultivars condition with 50% weed removal. This means that local cultivar better able to at density of 7 plants per square meter by treatment with 50% weed removal overcome on community of remaining natural weed the (Figure 7).

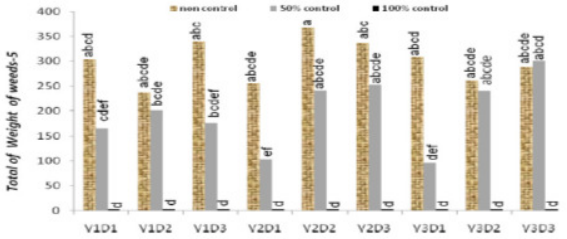

Fig. 9: Effect of density, weed control and Cultivar in Total Weight of broadleaf and of narrow leaf -5

Figure 8 shows that the highest weight of broadleaf and narrow leaf weeds on fourth stage was obtained under condition with 50% weed removal density of 7 plants per square meter and at the Saraziri cultivar. This means that treatment with 50% weed removal at density of 14 plants per square meter and at Saraziri cultivar, didn't effect on the natural weed and weeds have been able to overcome on crop at this situation. It also shows the local cultivar at density of 7 plants per square meter with applied treatment and removal of weeds could compete with weeds and control them and as is seen in the figure, is controlled weed better than the other cultivars on this condition.

The highest weight of broadleaf and narrow leaf weeds on fifth stage was obtained under condition of without weed control in the Saraziri cultivar and density of 7 plants per square meter (Figure 9). Also this figure shows that the lowest weight of narrow leaf and broadleaf weeds was obtained by applying treatment with weed removal at the local cultivar and under conditions with density of 7 plants per square meter. At local cultivar, by increasing plant density from 7 to 11 and 14 on this stage, is

decreased the efficiency of this treatment plant of weed removal. This means applying treatment of weed removal at high densities in the local cultivar couldn't affect on the natural weed community. In fact, with intensification of the competitive effects of weeds due to increasing time in the field, as well as reducing crop density, increased weight of dried weed. Similar results have been reported in this case by Mandany et al (2007) and Dabaghzadeh et al (2010).

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