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86/4/9 :

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E-mail:agolchin2002@yahoo.com

1382

81/2/31 81/2/19)

(COS16 5)

(30 25 20 15)

(81/3/12

COS16

5

1/w = a + bp

: p

COS16 5

: y

:1/w

y = p / a + bp

: b,a

Relationship Between Plant Density and Grain Yield of Three Pinto Bean Cultivars at Different Sowing Dates

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Abstract

In order to investigate the relationship between plant density and grain yield of three pinto bean cultivars at three different sowing dates, a split plot factorial experiment based on randomized complete block design (RCBD) and three replications was conducted in Zanjan Agricultural Research Center in 2003. Three pinto bean cultivars (Talash, Khomein 5 and COS16) at three different sowing dates (9 May, 21 May and 2 June) with four densities (15, 20, 25 and 30 plants/m²) were sown in a loamy soil. Days to flowering, pods per plant, seeds per plant, 100 seeds weight, days to maturity and grain yield were significantly affected by sowing date, cultivar and plant density. The interaction effects of sowing date and cultivar were also significant for days to flowering, days to maturity and grain yield but interaction effects of sowing date and plant density were only significant for days to flowering and grain yield. All these traits were decreased with delaying in sowing date. Grain yield of COS16 was higher than that of Talash and Khomein 5. Days to flowering, pods per plant, seeds per plant, 100 seeds weight and days to maturity decreased, but empty pods per plant and grain yield per unit area increased, with increasing plant density. The relationship between plant density and grain yield of the three pinto bean cultivars were analysed, using equations $1/w = a+bp$ and $y = p/a+bp$, where: $1/w$ = reciprocal of yield per plant, y = grain yield per unit area, p = plant density, a and b = constants. The results indicated that delayed sowings reduce grain yield of low densities more than that of high densities. Consequently, estimated optimum economic densities for delayed sowings were more than those for early sowings. Therefore, it is necessary to increase seeding rate at delayed sowings, in order to prevent or to reduce the yield loss.

Key Words : Pinto bean, Plant density, Sowing date, Yield, Yield components

40 35 30 25 20

(Phaseolus vulgaris)

(20 25)

)

20

.(1373

3233

35

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.(1373

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(1969)

(Asymptotic)

(1992)

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(1969)

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1381 82

$$1/w = a + bp \quad [1]$$

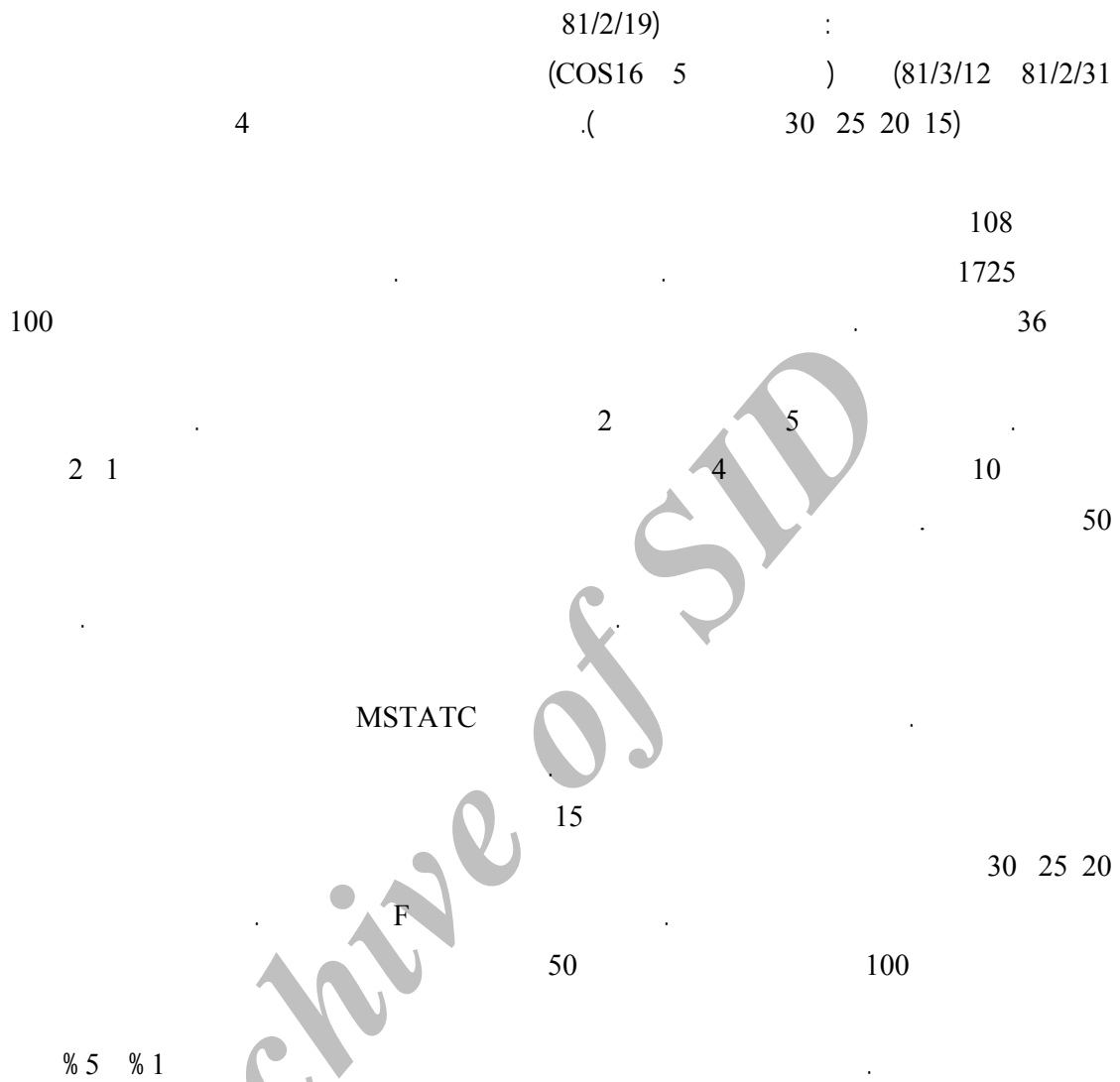
$$y = p / a + bp \quad [2]$$

: a :w

:p :b

:y

/1	18	/	...	106
				1387



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30

(6)

(2)

)
(

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(3) COS16

)

(

(1988)

(1980)

5

(1994)

×

5

COS16

(3)

15

30

15

(4)

30

×

(4)

(1)

(2)

15

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(1984)

(1990)

COS16 (1) 5 COS16
 5 (3) 5 (3)
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 (3) 5 COS16

(1990)

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5

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(2)

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5 .(1) % 1

3915 COS16 .(3) 39/17 51/45 COS16

3658 .(3)

COS16 .(4)

x

5

COS16

COS16 (1986)

5

(1990)

.(4)

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x

30

24

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26 5
27 COS16

(.6 4)

COS16

(1981)

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26

29

(1/w)

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1

(7)

COS16

(.5.3.1)

17/24 7/69

5

(.7)

(7

R² > 0.97)

28

COS16

2

30

(y)

30 29

2

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4 2

(2)

(.6 4

7/14

26

3 2

COS16

13/33

80

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$$\begin{aligned} & \times & \times & & 27 \\ & = & & \times & \\ & \times & \times & & (7 \quad) & 10 \quad 8/47 \\ & & = & & & 6 \quad 4 \quad 2 \end{aligned}$$

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7

()	()	a+bx			
		R ²	b	a	
3957	24	0/984	2/291 * 10 ³	8/63 * 10 ⁴	81/2/19
3831	26	0/975	3/35 * 10 ³	1/15 * 10 ²	81/2/31
3749	29	0/968	4/022 * 10 ³	2/016 * 10 ³	81/3/12
3987	26	0/985	2/277 * 10 ³	8/34 * 10 ⁴	81/2/19
3812	28	0/975	3/322 * 10 ³	1/135 * 10 ²	81/2/31
3743	30	0/969	3/976 * 10 ³	1/978 * 10 ²	81/3/12
4332	27	0/987	2/103 * 10 ³	7/85 * 10 ⁴	81/2/19
4027	29	0/978	3/08 * 10 ³	1/059 * 10 ²	81/2/31
3949	30	0/972	3/635 * 10 ³	1/772 * 10 ²	81/3/12

.1373

19

.1383

.496 483 .4

.1373

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892/74	17/194	3/374	238/712	0/483	0/583	0/139	22/750	2	
968933/3 **	1601/33 **	61/04 **	3243/16 **	0/160	1/51 **	4/54 **	1387/75 **	2	
787481/3 **	1861/33 **	1396/51 **	5693/76 **	2/77 **	0/41 **	12/44 **	457/33 **	2	
34283/3 **	57/33 **	13/64	205/61	0/019	0/06	0/07	9/33 **	4	x
1150229/0 **	128/66 **	150/24 **	8851/20 **	0/019	2/55 **	12/55 **	104/97 **	3	
23170/2 **	1/00	3/90	1216/67	0/006	0/02	0/16	1/97 *	6	x
648/73	0/12	6/23	138/75	0/023	0/01	0/07	0/17	6	x
165/23	0/03	2/33	6/35	0/013	0/03	0/003	0/08	12	x
609/80	0/82	6/92	70	0/042	0/11	0/65	0/72	70	
							%1 %5		** *

2

42/92 C	49/00 B	55/33 A
11/80 B	14/37 AB	17/195 A
2/01 A	1/41 A	0/98 B
41/31 B	50/37 B	60/29 A
43/50 B	44/51 B	46/08 A
108/7 C	115/7 B	122/0 A
3599 C	3712 B	3922 A

% 1

3

COS16	5		
46/64 C	47/97 B	52/64 A	
19/01 A	10/68 C	13/68 B	
1/75 A	1/32 B	1/41 B	
65/03 A	41/65 B	45/29 B	
3/489 B	3/927 A	3/414 B	
39/17 C	51/45 A	43/48 B	
110/3 C	112/3 B	123/7 A	
3915 A	3660 B	3658 B	

% 1

4

30	25	20	15
46/89 D	48/11 C	50/00B	51/33 A
9/60 C	BC 11/94	14/87 B	21/45 A
2/42 A	1/64 B	1/10C	0/826 C
33/47 C	41/74BC	52/13 B	75/28 A
44/84 C	44/16 B	45/29 B	47/50 A
112/9 D	114/6 C	116/4 B	117/9 A
3920 A	3858 B	3744 C	3455 D

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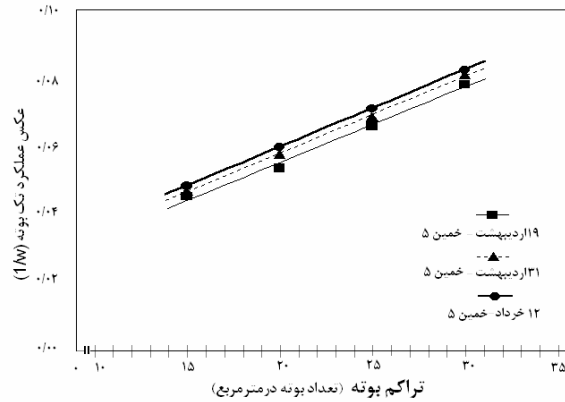
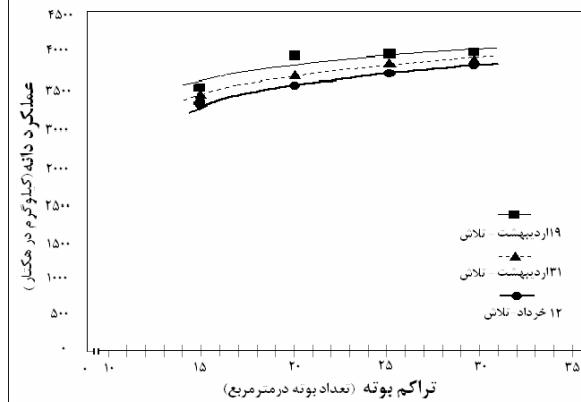
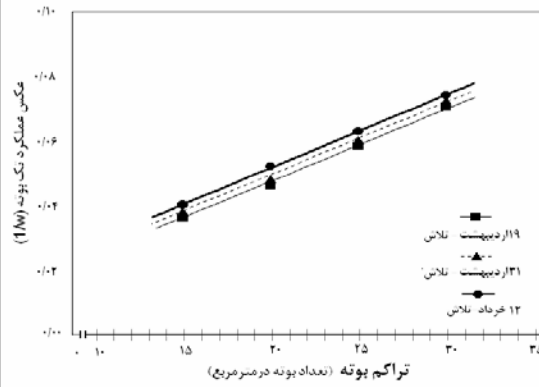
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()	()	a+bx			
		R ²	b	a	
3957	24	0/984	$2/291 * 10^3$	$8/63 * 10^4$	81/2/19
3831	26	0/975	$3/35 * 10^3$	$1/15 * 10^2$	81/2/31
3749	29	0/968	$4/022 * 10^3$	$2/016 * 10^3$	81/3/12
3987	26	0/985	$2/277 * 10^3$	$8/34 * 10^4$	81/2/19
3812	28	0/975	$3/322 * 10^3$	$1/135 * 10^2$	81/2/31
3743	30	0/969	$3/976 * 10^3$	$1/978 * 10^2$	81/3/12
4332	27	0/987	$2/103 * 10^3$	$7/85 * 10^4$	81/2/19
4027	29	0/978	$3/08 * 10^3$	$1/059 * 10^2$	81/2/31
3949	30	0/972	$3/635 * 10^3$	$1/772 * 10^2$	81/3/12

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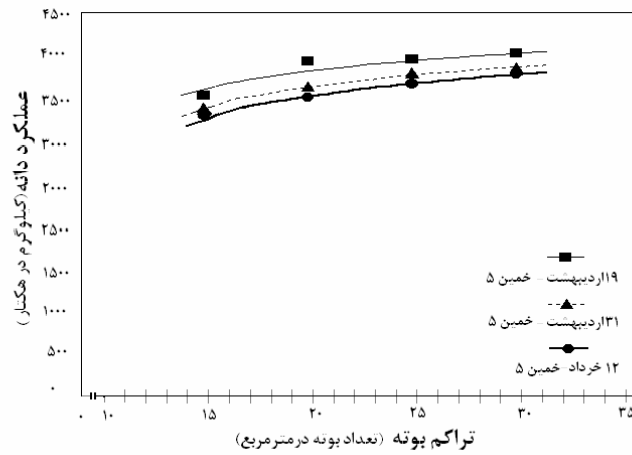
COS16

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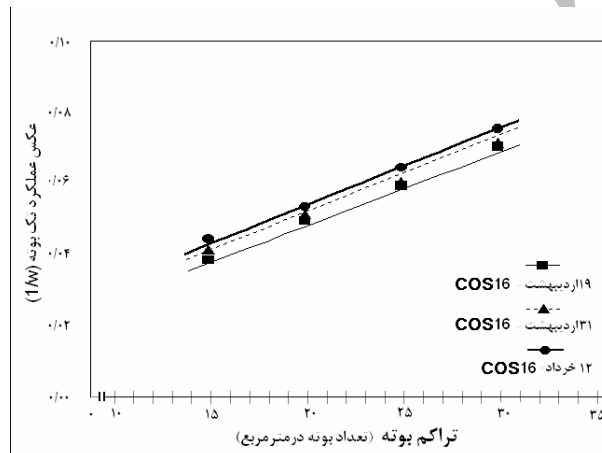


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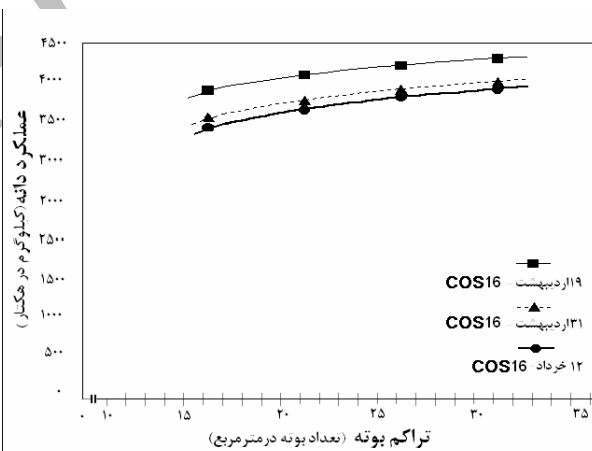


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COS16

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COS16

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