



## Yield, economics, nutrient uptake and quality of coriander (*Coriandrum sativum*) under different sowing time, varieties and plant growth regulators

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### ABSTRACT

A field experiment was carried out in *rabi* seasons of 2011-12 and 2012-13 at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Rajasthan), to assess the effect of sowing time and plant growth regulators on yield, economics, nutrient uptake and quality of coriander (*Coriandrum sativum* L.) varieties grown under irrigated loamy sand soil of semi-arid eastern plain zone of Rajasthan. The experiment consisting of two sowing times, viz. normal (1<sup>st</sup> week of November) and late (3<sup>rd</sup> week of November), three varieties, viz. RCr-41, RCr-435 and RCr-480 and five plant growth regulators treatments (PGRs), viz. triacontanol @ 1 000 ppm, brassinolide @ 1.0 ppm, thiourea @ 1 000 ppm and NAA @ 50 ppm, including one control (water sprayed) treatment were replicated thrice in split-plot design. The 2-year results revealed that the normal sown coriander crop produced significantly higher seed (by 31%) and stover yields, total N and P uptake (by 20 and 25%), per-day productivity (by 17%) and net returns (by 59%), partial factor productivity (PFP), nutrient harvest index (NHI), protein (by 21%) and oil (by 41%) yields compared to late sown crop. However, late sown crop resulted significantly higher nitrogen content in seed and stover and protein content in seed over normal sown. Among 3-varieties, RCr-480 produced significantly higher yields (15%), total N (15%) and P (by 14%) uptake, per-day productivity (by 14%) and net returns (by 34%), essential oil (by 21%) and protein (17%) yields, PFP-NP and NHI-NP during both the years as compared to RCr-41, which were statistically at par with RCr-435, except oil yield, NHI-NP in second year. The foliar spray of PGRs significantly enhanced the yields (by 10-22%), nutrient content and uptake and quality of coriander over water spray. The highest seed and stover yields, N and P uptake, per-day productivity and net returns, protein and oil yield and PFP-NP with 1 000 ppm triacontanol, over control, 50 ppm NAA and 1 000 ppm thiourea, and remained statistically at par with 1.0 ppm brassinolide, except per-day-net returns and oil yield. Overall, our results suggest that adoption of RCr-480 variety under normal sown condition with 1 000 ppm triacontanol spray can enhance crop productivity, profitability, nutrient uptake and quality of coriander in semi-arid region of India and elsewhere under similar agro-climatic conditions.

**Key words:** Coriander, Nutrient uptake, Partial factor productivity, Plant growth regulators, Profitability

Coriander (*Coriandrum sativum* L.) is one of the oldest seed spices most widely used by the mankind as condiment. The green leaves and fruits of coriander have a pleasant aromatic odour due to presence of 'coriandrol'. Good quality oleoresin has extracted from coriander seed which can be used for flavouring beverages, sweets, pickles, sausages, snacks, etc. The research findings across the country conclusively revealed negative impact of delayed sowing on yield, nutrient content and uptake and quality of seed especially on test weight but the extent of reduction depends

upon the prevailing weather conditions. A late sown crop produces shrivelled grains as well as poor quality compared to early sowing leading to low yield.

Selection of proper improved variety as per the growing conditions is another way to improve the productivity and quality of the crop. All the three (RCr-41, RCr-435 and RCr-480) varieties are suitable for normal conditions and covers a large area of state but yield stagnation has been reported prevailing management practices. Therefore, it was felt necessary to enhance the productivity of coriander through alternative practices like use of PGRs. Use of triacontanol, brassinolide, thiourea and NAA based PGRs has been reported to induce physiological efficiencies including photosynthetic ability of plants (Jain *et al.* 1988, Sarada *et al.* 2008), growth promoting activity (Mandava 1988), also improve the resistance in plant against the water, salinity, low and high temperature stresses (Rao *et al.* 2002), improve the dry matter partitioning and subsequently enhance the

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productivity of crops and may mitigate the problem of late sowing to bring marked biological activity in plants (Sahu and Solanki 1991). Thus, for achieving the attainable yield potential with good quality of the crop the optimum time of sowing, adoption of most suitable varieties and application of plant growth regulators are essentially required. So keeping in view the above facts, the present investigation has been planned to evaluate the effect of sowing times, varieties and plant growth regulators on yield, economics, nutrient uptake and quality of coriander.

#### MATERIALS AND METHODS

A field experiment was conducted for two consecutive years in *rabi* seasons of 2011-12 and 2012-13 at the Agronomy Farm, S K N College of Agriculture, Jobner, situated at 27° 05' N latitude, 75° 28' E longitude and at an altitude of 427 AMSL in Jaipur district of Rajasthan. This region is categorized as semi-arid eastern plain zone of Rajasthan. The soil of the experimental site was loamy sand in texture with low in organic carbon (0.16%) and available nitrogen (126.5 kg/ha), medium in available phosphorus (16.7 kg/ha) and potassium (171.9 kg/ha) and alkaline in reaction with pH 8.3. The experiment consisting of two sowing times viz., normal (1<sup>st</sup> week of November) and late (3<sup>rd</sup> week of November), 3-varieties, viz. RCr-41, RCr-435 and RCr-480 as main plot treatments and five treatments of plant growth regulators viz., triacontanol @ 1 000 ppm, brassinolide @ 1.0 ppm, thiourea @ 1 000 ppm and NAA @ 50 ppm including control (water sprayed) as sub-plot treatment, total 30 treatment combinations were replicated thrice in split plot design. Before sowing coriander varieties seed was treated with bavistin @ 2 g/kg of seed. The crop was sown in rows at 30 cm apart and 2-3 cm depth with a seed rate of 12 kg/ha as per treatments under normal and late sown conditions. A uniform dose of 60 kg N, 40 kg P<sub>2</sub>O<sub>5</sub> and 20 kg K<sub>2</sub>O/ha was applied in all plots. Entire quantity of P and K and half dose of N were applied at the time of sowing and the remaining nitrogen was applied in two equal splits with third and fourth irrigations. Two foliar spray of triacontanol @ 1 000 ppm, brassinolide @ 1.0 ppm, thiourea @ 1 000 ppm and NAA @ 50 ppm were done at 40 and 70 days after sowing. The spray volume was 400 and 600 litres/ha for application at 40 and 70 DAS, respectively.

Coriander was sown on 4<sup>th</sup> and 1<sup>st</sup> November (under normal condition) and 19<sup>th</sup> and 16<sup>th</sup> November (under late sown condition) in 2011 and 2012, respectively, and the crop was harvested on 22 and 21 March during 2012 and 2013, respectively. The plant samples were collected at harvest and dried in oven ( $\pm 70^{\circ}\text{C}$ ), processed and thoroughly mixed and analyzed for estimation of nitrogen, phosphorus and essential oil content was by Kjeldahl, Vanado-molybdate yellow colour and Clevenger apparatus, respectively. N and P uptake were calculated by formula (Nutrient content/100 multiplied by seed/stover yield in kg/ha). The estimated values of different nutrient use indices viz; partial factor productivity (PFP), and harvest index (HI) of applied N and P were computed by using the formulas as suggested by

Fageria and Baligar (2003) and Dobermann (2005) which are as follows:

$$\text{Partial factor productivity of applied nutrient (PFP)} = Y_t / N_a$$

$$\text{Nutrient harvest index (\%)} = N_s / N_t \times 100$$

where,  $Y_t$  = Yield under treatment plots (kg/ha);  $N_a$  = Amount of nutrient added (kg/ha);  $N_s$  = Nutrient uptake by seed at harvest;  $N_t$  = Nutrient uptake by whole plant (seed + stover) at harvest.

Yield, nutrient uptake and quality parameters were measured as per standard procedures. Economics was calculated based on prevailing cost of input and output in local market. All the data were statistically analyzed using the analysis of variance (ANOVA) techniques (Gomez and Gomez 1984). The critical difference at 0.05% level probability were calculated to assess the significance between treatments.

#### RESULTS AND DISCUSSION

##### *Effect of sowing time*

The sowing times significantly influenced the yield, economics, nutrient content and uptake and quality parameters of coriander. Normal sown crop resulted significantly higher seed (1456 and 1501 kg/ha) and stover (2150 and 2221 kg/ha) yields (Table 1), productivity (10.40 and 10.65 kg/day/ha) and net returns (₹ 228 and 239/day/ha) in 2011-12 and 2012-13 over late sown crop, respectively (Table 2).

It is an established fact that sinks capacity largely governs crop productivity (Evans 1975). This might be due to favourable environmental conditions available to the crop during its initial growth, flowering and fruiting stages. The possible reason for low yield in delayed sowing might be due to availability of insufficient time for vegetative growth as the plant entered the reproductive phase at a faster rate. These results are in conformity with the findings of Meena *et al.* (2006) and Bhadkariya *et al.* (2007).

The similar results were observed in total (seed + stover) N (62.5 and 66.5 kg/ha) and P (13.2 and 14.3) uptake (Fig 1 and 2) as well as uptake in seed and stover individually, total NP-PFP (14.56 and 15.01) and NHI of (65.0 and 64.6%) as well as individual nutrient PFP and NHI was significantly higher with normal sown crop compared to late sown crop in 2011-12 and 2012-13, except NHI-N and NHI-NP in 2011-12, respectively (Table 1, 2 and 3). However, N content in seed and N and P content in stover were significantly higher with late sown crop during both the years. Therefore, the nitrogen content in both seed and stover followed a reverse trend to that of seed and stover yield. A decreased nitrogen content under normal sown crop could be due to the dilution effect by higher yield. The increased nitrogen and phosphorus uptake under normal sown crop could be ascribed due to higher total biomass production. Thus, significant improvement in seed and stover yield by virtue of higher photosynthesis under normal sown crop ultimately resulted in higher uptake of nitrogen and

Table 1 Effect of sowing time, varieties and plant growth regulators on yields, nitrogen content and uptake in seed and stover of coriander

Treatment	Seed yield (kg/ha)		Stover yield (kg/ha)		N content (%)				N uptake (kg/ha)			
					Seed		Stover		Seed		Stover	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
<i>Sowing time</i>												
Normal	1456	1501	2150	2221	2.84	2.92	0.969	1.005	41.5	44.0	21.0	22.5
Late	1106	1143	1735	1807	3.09	3.16	1.026	1.065	34.3	36.2	17.6	19.0
SEM±	22	21	33	32	0.04	0.03	0.012	0.011	0.44	0.42	0.22	0.22
CD (P=0.05)	69	66	104	100	0.11	0.10	0.037	0.035	1.37	1.31	0.70	0.68
<i>Varieties</i>												
RCr-41	1179	1217	1853	1921	2.90	2.98	0.979	1.017	34.1	36.2	17.8	19.2
RCr-435	1316	1356	1998	2069	3.02	3.08	1.012	1.050	39.6	41.7	20.1	21.6
RCr-480	1347	1393	1976	2053	2.98	3.06	1.003	1.038	40.0	42.5	19.9	21.4
SEM±	27	26	40	39	0.04	0.04	0.014	0.014	0.53	0.51	0.27	0.27
CD (P=0.05)	85	81	127	123	NS	NS	NS	NS	1.68	1.61	0.86	0.83
<i>Plant growth regulators</i>												
Control	1128	1178	1733	1825	2.66	2.72	0.918	0.952	29.9	31.9	15.8	17.3
Tricantanol @ 1000 ppm	1380	1421	2061	2152	2.97	3.06	1.009	1.048	40.8	43.3	21.2	22.4
Brassinolide @ 1 ppm	1365	1398	2109	2107	3.06	3.13	1.020	1.058	41.6	43.6	20.7	22.1
Thiourea @ 1000 ppm	1273	1315	1949	2052	3.11	3.19	1.029	1.067	39.4	41.8	20.1	21.8
NAA @ 50 ppm	1258	1298	1860	1935	3.03	3.10	1.012	1.050	37.9	40.1	18.7	20.2
SEM±	24	25	37	38	0.05	0.04	0.015	0.015	0.56	0.54	0.29	0.28
CD (P=0.05)	69	70	104	106	0.13	0.12	0.043	0.042	1.60	1.54	0.81	0.79

Table 2 Effect of sowing time, varieties and plant growth regulators on phosphorus content and uptake in seed and stover, per day productivity and net returns of coriander

Treatments	P content (%)				P uptake (kg/ha)				Productivity/day (kg/ha)		Net returns/day (Rs/ha)	
	Seed		Stover		Seed		Stover					
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
<i>Sowing time</i>												
Normal	0.530	0.550	0.253	0.269	7.73	8.27	5.48	6.02	10.40	10.65	228	239
Late	0.538	0.560	0.269	0.283	5.96	6.41	4.60	5.03	8.85	9.07	143	154
SEM+	0.007	0.006	0.003	0.003	0.10	0.09	0.06	0.06	0.16	0.15	3	3
CD (P=0.05)	NS	NS	0.010	0.011	0.31	0.28	0.19	0.18	0.50	0.48	11	10
<i>Varieties</i>												
RCr-41	0.525	0.548	0.256	0.273	6.19	6.66	4.66	5.16	8.86	9.08	155	165
RCr-435	0.540	0.560	0.265	0.279	7.11	7.59	5.27	5.75	9.89	10.11	196	207
RCr-480	0.537	0.558	0.261	0.275	7.24	7.77	5.18	5.67	10.12	10.39	206	218
SEM+	0.009	0.007	0.004	0.004	0.12	0.11	0.07	0.07	0.20	0.19	4	4
CD (P=0.05)	NS	NS	NS	NS	0.38	0.35	0.23	0.22	0.62	0.59	13	13
<i>Plant Growth Regulators</i>												
Control	0.513	0.534	0.248	0.261	5.78	6.29	4.27	4.73	8.47	8.78	149	163
Tricantanol @ 1000ppm	0.538	0.559	0.262	0.277	7.42	7.94	5.50	5.92	10.37	10.60	218	228
Brassinolide @ 1 ppm	0.545	0.565	0.268	0.284	7.44	7.89	5.43	5.94	10.26	10.43	186	195
Thiourea @ 1000 ppm	0.540	0.562	0.266	0.281	6.87	7.39	5.20	5.73	9.56	9.81	190	201
NAA @ 50 ppm	0.534	0.555	0.259	0.276	6.72	7.20	4.79	5.31	9.45	9.68	185	196
SEM+	0.008	0.008	0.004	0.004	0.11	0.10	0.07	0.07	0.18	0.18	4	4
CD (P=0.05)	0.024	0.022	0.011	0.011	0.31	0.28	0.21	0.21	0.52	0.52	10	11

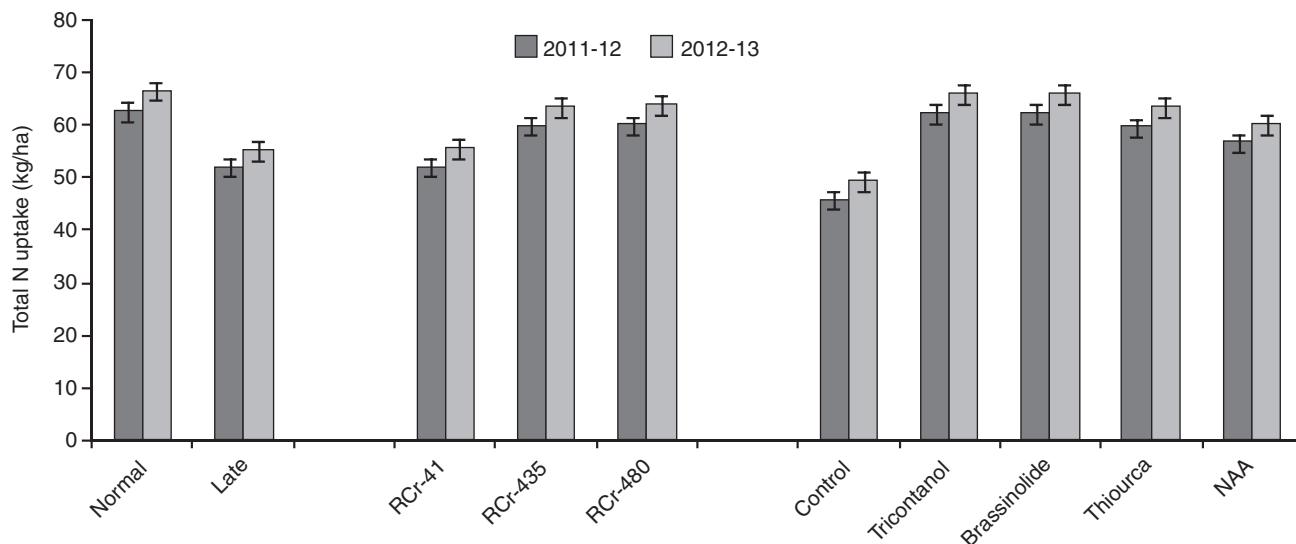


Fig 1 Effect of sowing time, varieties and plant growth regulators on total N uptake by coriander

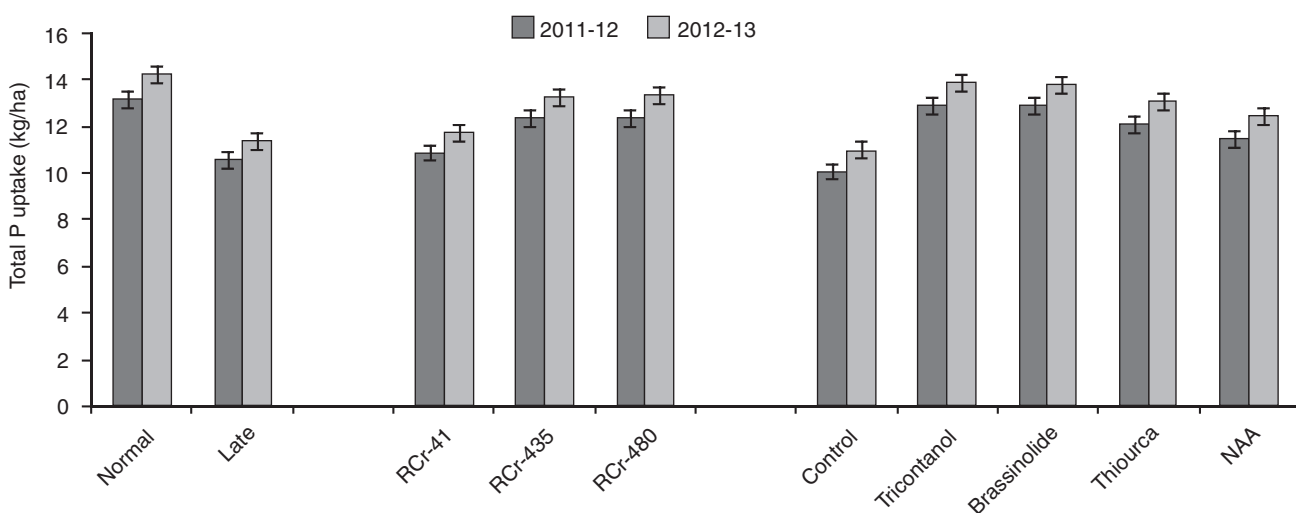


Fig 2 Effect of sowing time, varieties and plant growth regulators on total P uptake by coriander

phosphorus over late sown crop.

Quality parameters (protein and essential oil content in seed) of coriander were also significantly influenced with sowing times (Table 4). The significantly higher protein yield (260 and 275 kg/ha), oil yield (5.58 and 5.96 kg/ha) and essential oil content in seed were observed with normal sown crop as compared to late sown crop, while significantly higher protein content in seed was recorded with late sowing during both years, respectively. The reason could be traced back in temperature mediated effects on plants physiological processes and adequate absorption of nutrients. These findings are in close conformity with the findings of Balai and Keshwa (2011).

#### Effect of varieties

Coriander varieties performed differentially due to agronomic management and application of PGRs. RCr-480 recorded significantly higher seed (1 347 and 1 393 kg/ha), stover (1 976 and 2 053 kg/ha) yields (Table 1), crop

productivity (10.12 and 10.39 kg/day/ha) and net returns (₹ 206 and 218/day/ha) compared to RCr-41 and being at par with RCr-435 during 2011-12 and 2012-13, respectively. The RCr-480 variety resulted in average (mean of 2-year) increase of 14, 7, 14 and 33% in seed yield, stover yield, per-day-productivity and net returns over RCr-41. Thus, the improvement in above these regulative processes of coriander evidenced from higher biomass and nutrients accumulation in RCr-480 and RCr-435 varieties over RCr-41. The marked variation in yield and economics of these varieties RCr-480, RCr-435 and RCr-41 were also observed under multi-location trials conducted under AICRP on spices (AICRPS, 2011 and Balai and Keshwa 2010).

Nutrient uptake and quality of coriander seed were also significantly differed in all the 3-varieties (Table 1, 2 and 3). However, the N and P content in seed and stover of all the varieties remained statistically at par. Total uptake of N (59.9 and 63.9 kg/ha) and P (12.4 and 13.4 kg/ha) (Fig 1 and 2) as well as individual N and P uptake by seed and stover,

Table 3 Effect of sowing time, varieties and plant growth regulators on partial factor productivity (PFP) and nutrient harvest index (NHI) of nitrogen and phosphorous in coriander

Treatment	PFP-N		PFP-P		PFP-NP		NHI-N		NHI-P		NHI-NP	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
<i>Sowing time</i>												
Normal	24.26	25.02	36.39	37.53	14.56	15.01	66.4	66.0	58.5	57.8	65.0	64.6
Late	18.43	19.05	27.65	28.58	11.06	11.43	66.1	65.6	56.5	56.0	64.4	63.9
SEM±	0.37	0.35	0.55	0.53	0.22	0.21	0.3	0.1	0.4	0.0	0.2	0.1
CD (P=0.05)	1.16	1.11	1.73	1.66	0.69	0.66	NS	0.3	1.4	0.1	NS	0.3
<i>Varieties</i>												
RCr-41	19.65	20.28	29.48	30.43	11.79	12.17	65.6	65.2	57.0	56.3	64.1	63.7
RCr-435	21.94	22.60	32.90	33.90	13.16	13.56	66.3	65.8	57.3	56.8	64.8	64.2
RCr-480	22.45	23.22	33.68	34.83	13.47	13.93	66.7	66.5	58.2	57.7	65.3	64.9
SEM±	0.45	0.43	0.68	0.65	0.27	0.26	0.3	0.1	0.5	0.1	0.3	0.1
CD (P=0.05)	1.42	1.35	2.12	2.03	0.85	0.81	1.0	0.4	NS	0.3	0.9	0.3
<i>Plant growth regulators</i>												
Control	18.80	19.63	28.20	29.45	11.28	11.78	65.4	64.9	57.4	56.9	63.9	63.4
Tricontanol @ 1000 ppm	23.00	23.68	34.50	35.53	13.80	14.21	65.8	65.9	57.3	57.1	64.3	64.3
Brassinolide @ 1 ppm	22.75	23.30	34.13	34.95	13.65	13.98	66.8	66.3	57.7	56.9	65.2	64.7
Thiourea @ 1000 ppm	21.22	21.92	31.83	32.88	12.73	13.15	66.2	65.7	56.8	56.2	64.6	64.1
NAA @ 50 ppm	20.97	21.63	31.45	32.45	12.58	12.98	66.9	66.4	58.2	57.4	65.5	64.9
SEM±	0.40	0.41	0.61	0.62	0.24	0.25	0.2	0.1	0.3	0.3	0.2	0.1
CD (P=0.05)	1.15	1.17	1.72	1.76	0.69	0.70	0.5	0.3	0.9	0.8	0.5	0.3

total PFP (13.47 and 13.93) and NHI (65.3 and 64.9%) as well as individual nutrient PFP and NHI were recorded significantly higher with RCr-480 and remained at par with RCr-435 compared to RCr-41 in both the years. Nutrient uptake is a cumulative effect of content and biomass yield, so the varieties having higher content will not every time uptake the higher nutrients.

During both years essential oil content in RCr-480 variety seed (0.379 and 0.393%), oil yield (5.11 and 5.47 kg/ha) and protein yield (251 and 266 kg/ha) was recorded significantly higher as compared to RCr-41, respectively, being at par with RCr-435 (Table 4). The results of the present investigation indicate differential behavior of coriander varieties with respect to nutrient content, quality and its uptake is in close conformity with findings of other workers (AICRPS 2011 and Balai and Keshwa 2011).

#### Effects of plant growth regulators

Foliar spray of plant growth regulators (PGRs) significantly increased the yields, per-day-productivity and net returns of coriander as compared to water sprayed (control). Among the PGRs, foliar spray of 1000 ppm triacontanol enhanced significantly seed (1380 and 1421 kg/ha and stover (2061 and 2152 kg/ha) yields, productivity (10.37 and 10.60 kg/day/ha) and net returns (₹ 218 and 228/day/ha) as compared to water sprayed, 50 ppm NAA and 1000 ppm thiourea being at par with 1.0 ppm brassinolide (Table 1 and 2). Under all the PGRs

treatments the increase in seed and stover yields, per-day productivity and net returns was 10-22, 6-22, 10-22 and 20-46% over control, respectively. This might be due to the stimulatory effect of growth regulators which induced large number of reproductive sinks leading to greater activity of carboxylating enzymes (ribose 1,5-di phosphate carboxylase) resulting in higher photosynthetic rates with greater translocation and accumulation of metabolites in sink (Nehara *et al.* 2006) and ultimately higher seed yield. The cost of triacontanol was lower in comparison to added outputs. Thus, the increased seed yield led to higher net returns. The similar response with foliar spray of triacontanol was also reported by Nehara *et al.* (2006) in fenugreek and Sarada *et al.* (2008) in coriander.

Foliar application of plant growth regulators was also brought significant effect on nutrient content, uptake and quality of coriander (Table 1 and 2). Foliar spray of 1000 ppm thiourea recorded significantly higher nitrogen content in both seed (3.11 and 3.19%) and stover (1.029 and 1.067%) as compared to control but found to be statistically at par with other PGRs treatment. Phosphorus content in seed and stover were significantly higher under foliar spray of 1.0 ppm brassinolide as compared to control and statistically at par with other PGRs treatment. However, foliar spray of 1000 ppm triacontanol recorded significantly higher total N (62.0 and 65.7 kg/ha) and P (12.9 and 13.9 kg/ha) uptake (Fig 1 and 2) as well as individual nutrient uptake by seed and stover over control and 50 ppm NAA but

Table 4. Effect of sowing time, varieties and plant growth regulators on protein and essential oil content in seed and yields of coriander

Treatments	Protein content (%)		Protein yield (kg/ha)		Essential oil content (%)		Oil yield (kg/ha)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
<i>Sowing time</i>								
Normal	17.8	18.3	260	275	0.383	0.397	5.58	5.96
Late	19.3	19.8	215	227	0.357	0.370	3.95	4.23
SEM±	0.27	0.23	6	6	0.005	0.004	0.05	0.06
CD (P=0.05)	0.84	0.73	20	20	0.015	0.014	0.17	0.19
<i>Varieties</i>								
RCr-41	18.1	18.6	214	227	0.361	0.373	4.26	4.54
RCr-435	18.9	19.3	248	261	0.371	0.385	4.88	5.22
RCr-480	18.6	19.1	251	266	0.379	0.393	5.11	5.47
SEM±	0.33	0.28	8	8	0.006	0.005	0.08	0.09
CD (P=0.05)	NS	NS	24	24	0.018	0.017	0.23	0.24
<i>Plant growth regulators</i>								
Control	16.6	17.0	187	200	0.331	0.344	3.73	4.05
Tricantanol @ 1000 ppm	18.6	19.1	255	271	0.383	0.397	5.29	5.64
Brassinolide @ 1 ppm	19.1	19.6	261	273	0.371	0.384	5.06	5.37
Thiourea @ 1000 ppm	19.4	19.9	247	262	0.391	0.406	4.98	5.34
NAA @ 50 ppm	18.9	19.4	238	251	0.376	0.388	4.73	5.04
SEM±	0.28	0.27	8	8	0.006	0.005	0.06	0.07
CD (P=0.05)	0.80	0.76	22	22	0.016	0.015	0.18	0.20

remained statistically at par with 1.0 ppm brassinolide and 1000 ppm thiourea except in thiourea N uptake by stover during 2011-12, P uptake by seed in both the years and uptake by stover in 2011-12, respectively. The application of PGRs increased 22-36% and 14-28% in total N and P uptake over control. Total PFP (13.80 and 14.21) as well as individual nutrients PFP were recorded significantly higher with 1000 ppm triacontanol, and remained at par with 1.0 ppm brassinolide and total NHI (65.5 and 64.9%) with 50 ppm NAA, and remained at par with 1000 ppm thiourea and control in NHI-P as well as the individual nutrient as compared to other PGRs treatment and control.

However, the significantly higher protein (19.4 and 19.9%) and essential oil content (0.391 and 0.406%) in seed under 1000 ppm thiourea over control and 50 ppm NAA. The significantly higher protein yield (261 and 273 kg/ha) were recorded under 1.0 ppm brassinolide over control and oil yield (5.29 and 5.64 kg/ha) was recorded with 1000 ppm triacontanol than rest of the treatments of PGRs and control. The increase in nitrogen content in seed, stover, protein and essential oil content in seed with thiourea application might be due to improvement of metabolic processes and better growth and development, leading to greater absorption of nutrients from rhizosphere leads to increase yield and quality. Thiourea also creates better microbial population in soil which are responsible to mobilize essential nutrients. The quantum of nutrient uptake and oil yield by the crop is dependent on biomass production and nutrient content at cellular level. Since,

nutrients content are improved by application of PGRs, the total biomass production is primarily responsive for the quantum of nutrient uptake. These results are in close conformity with the findings of Balai and Keshwa (2011) and Nehara *et al.* (2006).

Thus, on the basis of results of 2-years investigation, it could be concluded that sowing of coriander variety RCr-480 in first week of November with foliar application of 1000 ppm triacontanol at 40 and 70 DAS gives higher yield, per-day-productivity and net returns, nutrient uptake and quality of coriander seed in semi-arid eastern plain zone of Rajasthan.

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