

Effect of soil and foliar nitrogen application on growth, yield and quality of baby corn cultivars

ABSTRACT

An imperative nitrogen management schedule attempted for the first time using soil application fb (followed by) foliar application at harvest stage to improve productivity and quality of baby corn. A two year study carried out in winter season with three cultivars and six schedules of recommended dose of nitrogen (RDN) application. Nitrogen scheduling in two, three and four splits compared on composite and hybrid cultivars. Crop growth, productivity traits, picking wise cob and corn yields, quality, plant nutrient ratios and nutrient harvest indices were determined. Cultivars followed the order HM-4>HQPM-1>Azad Uttam for yield components, yield and quality. HM-4 gave 7.0% and 31.6% higher mean baby corn yields than HQPM-1 and Azad Uttam. Soil fb foliar RDN application in 4 splits [50% as basal (B), 25% at knee height stage (KHS), 20% at tassel emergence (TE) fb 5% foliar spray after first picking (FSAFP)] recorded higher yield attributes, baby cob and corn yields, and quality. Nutrient ratios influenced due to cultivars and N application schedules. Nutrient harvest indices also varied due to N application schedule. HM-4 can be cultivated with RDN (150 kg ha⁻¹) in 4 splits (soil fb foliar) for attaining better yield and quality of winter baby corn. Further studies required for better understanding of combined approach under diverse conditions.

Keywords: Winter baby corn, nitrogen application schedules, combined approach, plant nutrient ratios, nutrient harvest indices

1. INTRODUCTION

Baby corn is an unfertilized dehusked baby cob harvested after emergence of 2-3 cm long silk [1]. Baby corn is a new crop for India and recently cultivation started in several states. Agro-techniques for baby corn differ from maize because of shorter crop duration and production of more baby cobs. Selection of suitable cultivar and proper nutrient supply particularly nitrogen are the major agro-techniques for achieving higher baby corn productivity. Medium stature, prolific and early maturing single cross hybrids have better yield potentiality than composites. Non availability of suitable cultivar may cause 30-45% reduction in yield [2]. Differential response of maize hybrids to utilize applied nitrogen depends on their genetic ability [3]; however, management practices play an important role in exploitation of the genetic potential.

Higher quantity of nitrogen required by the baby corn coinciding with the periods of efficient utilization to exploit its potential. Studies so far favors soil application of nitrogen in two or three splits at critical growth stages. Nitrogen application time is crucial to match with crop requirement [4,5]. Foliar urea sprays in appropriate concentrations and timing can increase baby corn productivity. Foliar-N application improved maize grain yield to significant extent [6], foliar spray as urea from tasseling to seed filling increased yield and quality [7]. Foliar application at anthesis or during next two weeks enhanced nitrogen content in corn grain [8]. A close relationship observed between maize productivity and N, P and K uptake by whole plant and grain. Nutrient content increases as whole plant biomass and subsequently the grain yield [9].

Suitable environmental conditions, longer duration and harvest period during winters provided ample opportunities for foliar nitrogen application. Informations regarding winter baby corn are scarce in India. Foliar applications of nitrogen at harvest stage may enhance baby corn yield and quality. There is need to rethink nitrogen management for its enhanced utilization by crop. No prior information available hence, this approach is attempted for the first time in winter baby corn. We hypothesize that combined approach (soil fb foliar) in nitrogen management using foliar urea application may improve yield and quality of baby

corn. The objective of this study was to analyze the effect of cultivars and nitrogen application schedules on growth, yield and quality parameters of baby corn.

2. MATERIALS AND METHODS

2.1 Treatments and cultural practices

Field experiments were conducted during 2011-12 and 2012-13 winter seasons at Agricultural Research Farm (25° 27'N, 82° 99'E), Banaras Hindu University, Varanasi, Uttar Pradesh, India. Soil of the experimental site was sandy clay loam, having 0.33% organic carbon content, EC 0.33 dSm⁻¹, pH 7.4, available N 191.3 kg ha⁻¹ [10], P 18.9 kg ha⁻¹ [11], K 181.2 kg ha⁻¹ [12], S 17.7 kg ha⁻¹ [13] and Zn 0.48 mg kg⁻¹ [14]. Factorial experiment was laid out following Randomized Complete Block Design with three replications. Three cultivars and six nitrogen application schedules were tested (Table 1). Plots were twelve rows, 4.8 m wide (40 cm row spacing) and 4.0 m in length. The uniform seed rate of 40 kg per ha adopted for raising the test crops. Recommended dose of nutrients were applied i.e. N, P, K, S and Zn (150-75-60-40-10 kg ha⁻¹). Recommended dose of nitrogen (RDN) was applied at the rate of 150 kg ha⁻¹ as per treatments schedule while remaining nutrients were applied as basal (B). Ureas, diammonium phosphate, muriate of potash, gypsum and zinc sulphate were used as fertilizer sources. Nitrogen management schedule involved two approaches i.e. soil application and soil application followed by (fb) foliar nitrogen supplementation as urea solutions (3%). Foliar spray after first picking (FSAFP) applied to the top of crop canopy in the respective treatments to provide a total of 7.5 kg N ha⁻¹ (5% RDN). The crop was harvested after 102 and 108 days after sowing (DAS) during first and second year respectively. Experimental site represents sub-tropical climate and received total rainfall of 31.80 mm and 6.40 mm during first and second growing season, respectively.

2.2 Morphophysiological measurements

Chlorophyll content (SPAD value) measurements were taken using Konica Minolta SPAD- 502 Chlorophyll Meter (Konica Minolta Sensing Americas, Inc., Ramsey, NJ). Crop growth rate and relative

growth rate computed as difference between dry matters accumulations, and by measuring difference between natural logarithm of dry matter accumulation divided by the time interval of observation [15].

Table 1. Cultivar and nitrogen application schedule treatments

Treatments	Symbol used
Cultivar	
HM - 4	V ₁
HQPM - 1	V ₂
Azad Uttam	V ₃
Nitrogen application schedule	
50% RDN as basal (B) + 50% RDN at Knee high stage (KHS)	N ₁
50% RDN as B + 50% RDN at Tassel emergence (TE)	N ₂
50% RDN as B + 25% RDN at KHS + 25% RDN at TE	N ₃
25% RDN as B + 50% RDN at KHS + 25% RDN at TE	N ₄
50% RDN as B + 25% RDN at KHS + 20% RDN at TE + 5% RDN after first picking as foliar spray (FSAFP)	N ₅
25% RDN as B + 50% RDN at KHS + 20% RDN at TE + 5% RDN as FSAFP	N ₆

Barren plants ha⁻¹, barrenness (%) and days taken to 50% silking (from three middle rows of each plot) were recorded. Baby cob weight and corn weight from each net plot were recorded and their ratio was expressed as cob: corn ratio. A maximum of four cobs / plant harvested from each net plot recorded as picking wise baby cob and corn yields and expressed in kg/ha.

2.3 Plant nutrient content and quality analysis

For nutrient content destructive sampling from the border rows were taken at final harvest. Samples of baby corn and above ground whole plant were dried to constant weight at 70°C for 24 hours and used for chemical estimation. N, P and K content were estimated as suggested by [12]. The nutrient harvest

indices viz., N harvest index (NHI), P harvest index (PHI) and K harvest index (KHI) were determined as the ratio between baby corn and whole plant N, P and K contents at maturity [16]. Carbohydrate content as suggested by [17], sugar content [18] and starch content [19] were estimated and expressed in percentage.

2.4 Statistical analysis

An analysis of variance (ANOVA) performed using SPSS (version 23). The analysis was based on two factors i.e. cultivars and nitrogen application schedules. All factors (cultivars, nitrogen application schedules) including year and replication was considered fixed factors. Respective graphs were prepared in Microsoft excel.

3. RESULTS AND DISCUSSION

3.1 Growth characters

Hybrids HM-4 and HQPM-1 possessed higher SPAD values than composite Azad Uttam at 45 and 60 DAS (Fig. 1). Mean SPAD readings of hybrids ranged from 46.6 to 57.3 across all sampling times [20]. Recommended nitrogen dose in two splits (N_1) recorded maximum SPAD value at 45 DAS while at 60 DAS it was with three splits (N_3). Result indicates that effect of split application was more pronounced at later stage of the crop growth (60 DAS). Overall, application of full nitrogen in three splits (N_3 and N_5) resulted significantly higher chlorophyll content closely followed by four splits (N_4 and N_6). Delayed application of half of the RDN at TE (N_2) contained minimum chlorophyll content irrespective of the crop growth stages. Significance of nitrogen application time for its efficient utilization at various plant growth stages has been advocated by other workers [4,21].

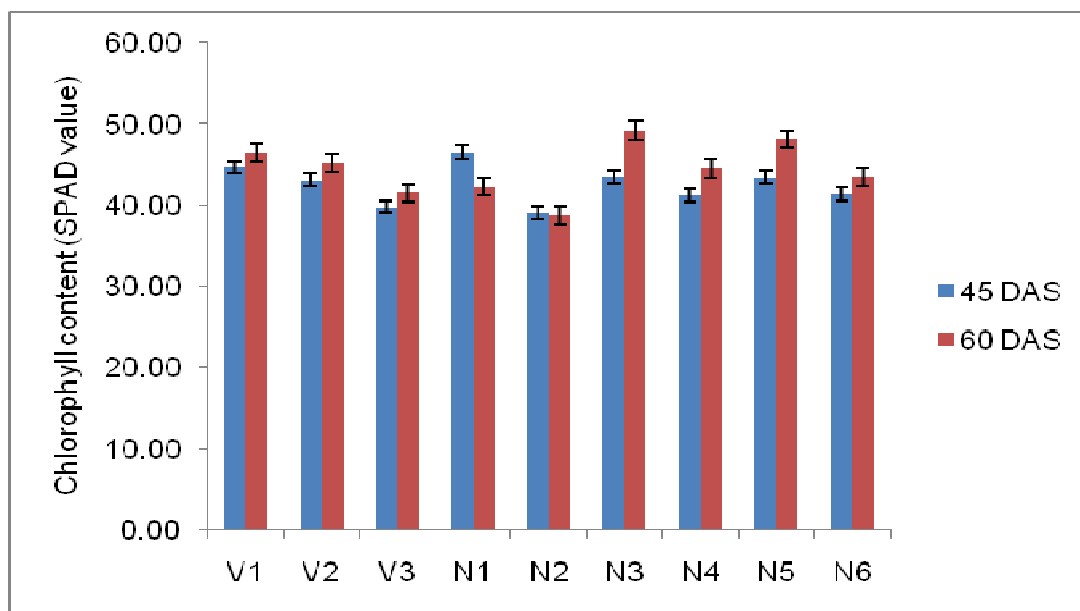


Fig. 1. Chlorophyll content (SPAD value) at 45 and 60 DAS of baby corn evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years). V₁ - HM-4, V₂ - HQPM-1, V₃ - Azad Uttam, N₁ - 50% B + 50% KHS, N₂ - 50% B + 50% TE, N₃ - 50% B + 25% KHS + 25% TE, N₄ - 25% B + 50% KHS + 25% TE, N₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP, N₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP. B - Basal, KHS - Knee height stage, TE - Tassel emergence, FSAFP - Foliar spray after first picking. **Error bars indicate standard error of the mean.**

Crop growth rate (CGR) (Fig. 2) found slow initially up to 30 DAS and observed most rapid between 30-45 DAS, thereafter declined considerably during 45-60 DAS. Higher values noted with composite Azad Uttam over hybrids HQPM-1 and HM-4. Variation in CGR may be due to the genetic characteristics of cultivars which caused differences in their dry matter accumulation. Reduction in growth rate with plant age was obvious since crop growth increased progressively with time to attain peak and thereafter declined. Split nitrogen application schedules caused variation in CGR except at early crop stage (0-15 DAS). Results indicated the significance of time and quantity of N applied. At 15-30 DAS, higher CGR noticed when crop received half of the RDN as basal (N₁, N₂, N₃ and N₅). At 30-45 DAS application of entire RDN early in two splits (N₁) resulted in maximum CGR closely followed by three splits (N₃) and four splits (N₅), respectively. At later growth stage (45-60 DAS), N applied in three splits was superior to four

and two splits, respectively. Proper nitrogen supply can positively affect crop growth rate because of increased chlorophyll content, enhanced photosynthetic capacity and rapid dry matter accumulation.

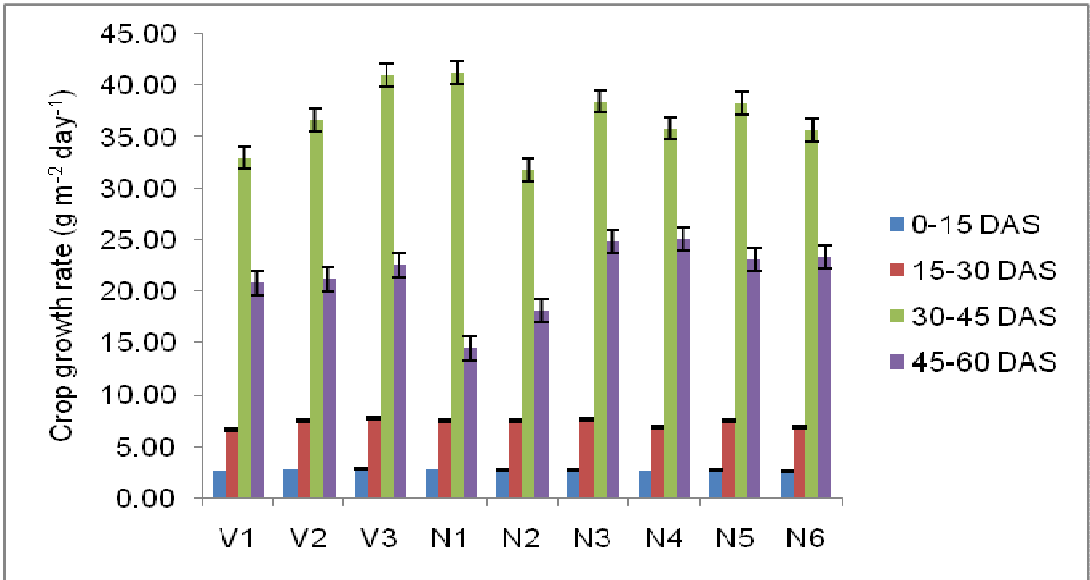


Fig. 2. Crop growth rate of baby corn during vegetative stage evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years). *V₁ - HM-4, V₂ - HQPM-1, V₃ - Azad Uttam, N₁ - 50% B + 50% KHS, N₂ - 50% B + 50% TE, N₃ - 50% B + 25% KHS + 25% TE, N₄ - 25% B + 50% KHS + 25% TE, N₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP, N₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP. B - Basal, KHS - Knee height stage, TE - Tassel emergence, FSAFP - Foliar spray after first picking. Error bars indicate standard error of the mean.*

Relative growth rate (RGR) (Fig. 3) enhanced during vegetative phase up to 45 DAS and then reduced to a great extent. Maximum RGR shown by the cultivar Azad Uttam followed by HQPM-1 and HM-4 up to 45 DAS however, reverse trend noted between 45-60 DAS. Effect of nitrogen application schedule on RGR was visible only with advancement in vegetative growth phase (30-45 DAS and 45-60 DAS) and no significant difference visible during early crop growth stages. Response to treatments suggests that reduced number of splits with late soil application (TE) of more nitrogen (N₂) greatly reduced RGR. Reduced number of splits (N₁) and addition of entire nitrogen at earliest could accelerate RGR only up to

45 DAS. However, increase in number of splits (three and four splits) resulted maximum RGR at 45-60 DAS irrespective of soil or combined (soil + foliar) application of nitrogen.

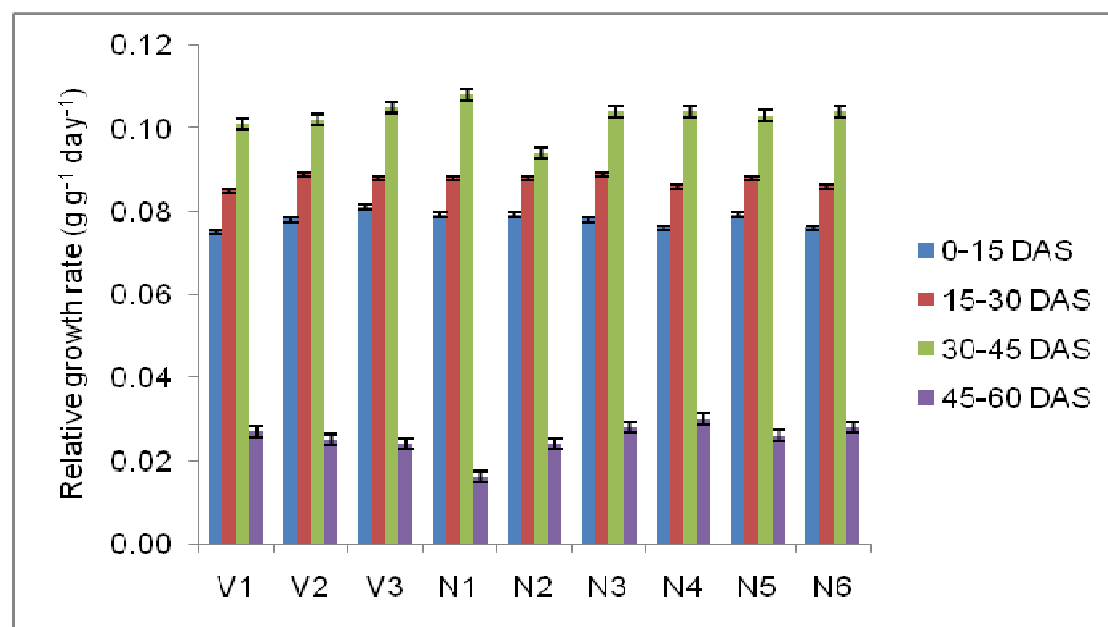


Fig. 3. Relative growth rate of baby corn during vegetative stage evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years). V₁ - HM-4, V₂ - HQPM-1, V₃ - Azad Uttam, N₁ - 50% B + 50% KHS, N₂ - 50% B + 50% TE, N₃ - 50% B + 25% KHS + 25% TE, N₄ - 25% B + 50% KHS + 25% TE, N₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP, N₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP. B - Basal, KHS - Knee height stage, TE - Tassel emergence, FSAFP - Foliar spray after first picking. Error bars indicate standard error of the mean.

Barrenness (%) and days taken to 50% silk emergence altered because of cultivars and remain unaffected by nitrogen application schedules (Table 2). Barren plants ha⁻¹ varied due to cultivars and nitrogen application schedules. Barren plants ha⁻¹ and barrenness (%) noted minimum with cultivar HM-4 while it was higher with Azad Uttam. Higher barrenness of composite cultivars than hybrids has been reported [22]. Variability in barrenness (%) is significantly influenced by the cultivars and higher degree of barrenness indicates poor development of sinks and reduced translocation of photosynthates. Hybrid HQPM-1 took more number of days for 50% silk emergence over rest of cultivars. Fast growth of cultivar Azad Uttam resulted in early silk emergence. Results support the findings of [23]. Barren plants per unit

area have been found to increase to a significant extent with reduction (two) in number of splits of nitrogen application from 3 or 4. Increase in number of splits might have facilitated enhanced availability and better opportunity for efficient nitrogen utilization.

3.2 Yield attributes and picking wise yield

Cob weight and cob: corn ratio (Table 2) differed due to cultivars. Hybrids produced heavier cobs (HM-4: 39.96 g, HQPM-1: 38.81 g) than composite Azad Uttam (36.13 g). Hybrids were at par and claimed narrow cob: corn ratio than composite cultivar. HM-4 performed best and this could be attributed to the differential behaviour of the cultivars which created variation in their specific attributes implying as characteristic of genotypes [24]. Recommended nitrogen applied in four splits (N_5) produced greatest baby cob weight however, three splits (N_3) also gave similar baby cob weight. Lowest cob weight recorded when N was applied in two equal splits (N_2). Nitrogen application schedule failed to influence baby cob: corn ratio. In general, increased splits (3/4) were more conducive for regulating nitrogen supply over less number of splits (2) for the crop plant. Further, appropriate partitioning and right time application of nitrogen dose (N_3 and N_5) augmented the overall effect. Nitrogen application in considerable amount near to anthesis results enhanced possibility of its accumulation in the sink than in other vegetative parts [25].

Table 2. Barren plants, barrenness, 50% silk emergence, cob weight and cob: corn ratio of baby corn grown at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years)

Treatments	Barren plants (No. ha ⁻¹)	Barrenness (%)	50 % silk emergence (days)	Cob weight (g)	Cob : corn ratio
V ₁ - HM-4	5224.87	4.51	75.04	39.96	4.77
V ₂ - HQPM-1	5313.05	4.61	79.70	38.81	4.82
V ₃ - Azad Uttam	7186.95	6.30	71.30	36.13	5.12

SEM ±	66.94	0.07	0.90	0.34	0.05
CD (p=0.05)	203.45	0.20	2.81	1.05	0.17
N ₁ - 50% B + 50% KHS	6040.56	5.24	76.01	37.62	4.92
N ₂ - 50% B + 50% TE	6128.75	5.33	76.98	34.19	4.94
N ₃ - 50% B + 25% KHS + 25% TE	5776.01	5.02	73.09	40.52	4.88
N ₄ - 25% B + 50% KHS + 25% TE	5864.20	5.11	75.62	38.19	4.91
N ₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP	5687.83	4.95	74.97	40.93	4.87
N ₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP	5952.38	5.19	75.41	38.35	4.90
SEM ±	94.66	0.09	1.28	0.48	0.08
CD (p=0.05)	287.72	0.29	3.97	1.49	0.24

SEM, standard error of mean

Overall, picking wise baby cob and corn yield followed the pattern of yield attributes and were in the order of II>I>III>IV, respectively (Fig. 4 and 5). Significant disparity among cultivars seen, and in 1st picking HQPM-1 produced higher baby cob and corn yields while from 2nd to 4th pickings HM-4 was high yielder. Of the total yields, only a small fraction received as 4th picking by hybrids. Azad Uttam failed in production of 4th cob and gave lowest yield among the test cultivars. Results are in agreement with the earlier findings of [26]. Hybrid HM-4 was superior in productivity traits evaluated over others because of low barrenness, heavier cob weight and narrow cob: corn ratio.

Nitrogen application schedules followed the order N₅>N₃>N₆>N₄>N₁>N₂ for cob and corn yields. Soil + foliar application treatments (N₅ and N₆) were actually derived by modifying treatments of nitrogen application in three splits. Utilization of 5% RDN as FSAFP (4 splits: N₅ and N₆) enhanced baby cob and

corn yields in subsequent three pickings received after the foliar application. Results establish the positive effect of foliar nitrogen application at harvest when combined to soil applications. Highest baby cob and corn yields by treatment N₅ (4 splits) calls for reallocation of N dose at right time and mode for efficient utilization. Nitrogen applied in three splits (N₃) ranked second in performance and found statistically similar to N₅ (4 splits). Both of above treatments proved superior to rest N application schedules. Results suggests that more splits (three) as soil applications are beneficial and further adding foliar urea spray to it enhances nitrogen utilization by the crop. Increased response to foliar urea is expected when nitrogen availability via soil is reduced. Application timings with variable N rates also affected the baby cob and corn yields. This could be ascertained by comparing between the treatments having similar number of splits i.e. N₁ & N₂, N₃ & N₄, N₅ & N₆. Similar results reported by many workers [7, 5].

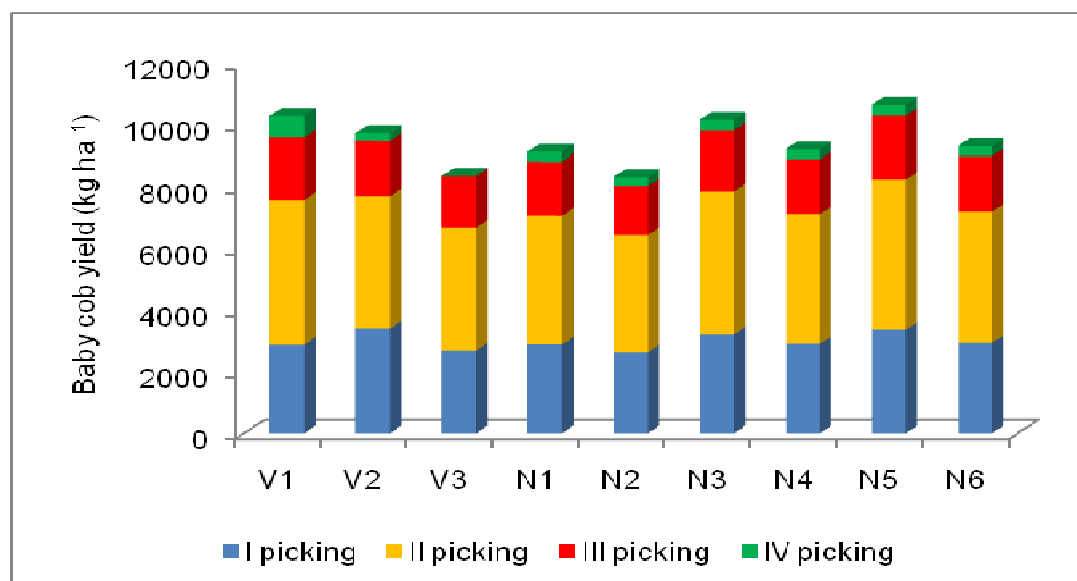


Fig. 4. Cob yield of baby corn evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years). V₁ - HM-4, V₂ - HQPM-1, V₃ - Azad Uttam, N₁ - 50% B + 50% KHS, N₂ - 50% B + 50% TE, N₃ - 50% B + 25% KHS + 25% TE, N₄ - 25% B + 50% KHS + 25% TE, N₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP, N₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP. B - Basal, KHS - Knee height stage, TE - Tassel emergence, FSAFP - Foliar spray after first picking

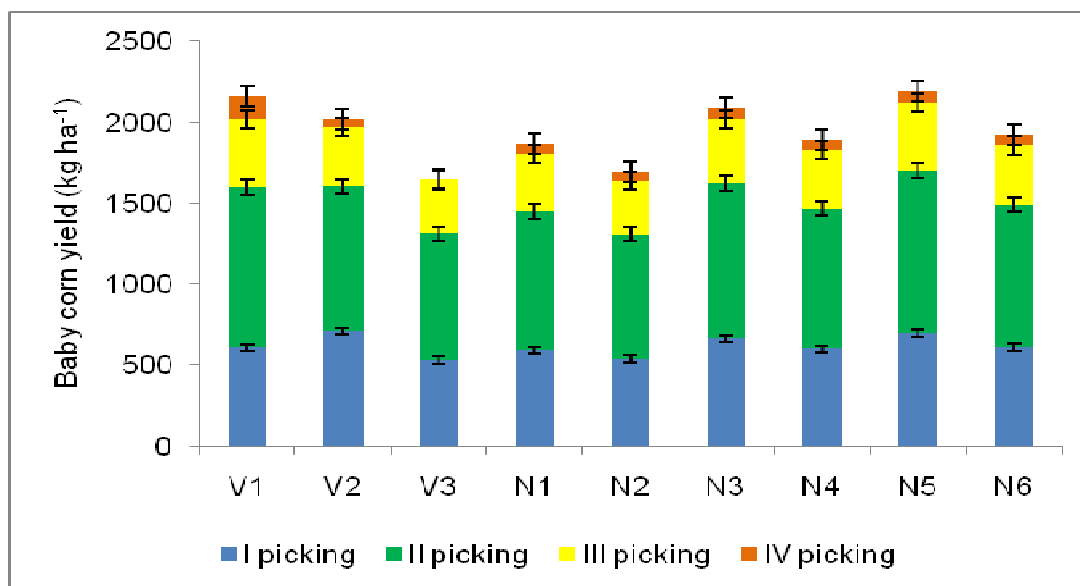


Fig. 5. Corn yield of baby corn evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years). V_1 - HM-4, V_2 - HQPM-1, V_3 - Azad Uttam, N_1 - 50% B + 50% KHS, N_2 - 50% B + 50% TE, N_3 - 50% B + 25% KHS + 25% TE, N_4 - 25% B + 50% KHS + 25% TE, N_5 - 50% B + 25% KHS + 20% TE + 5% FSAFP, N_6 - 25% B + 50% KHS + 20% TE + 5% FSAFP. B - Basal, KHS - Knee height stage, TE - Tassel emergence, FSAFP - Foliar spray after first picking. Error bars indicate standard error of the mean.

3.3 Quality parameters

The cultivars differ significantly with respect of carbohydrate content (%), starch content (%) and sugar content (%) in baby corn (Table 3). Higher values were recorded with HM-4 followed by HQPM-1 and Azad Uttam. Better quality parameters may be attributed to the differences in genetic factor as well as the leading cultivar (HM-4) adapted well to the environment. These results confirm the findings of [23]. Application of nitrogen in three splits (N_3) or four splits (N_5) showed highest and similar values of quality characters. Analysis of variance revealed above two treatments recorded significantly higher values of quality characters than other treatments. Foliar application of nitrogen at later stages of crop growth might have resulted into higher nitrogen accumulation in the green cob and increased biochemical reactions. Higher quality parameters noticed due to split application of N [27].

204 **Table 3. Quality parameters of baby corn evaluated at three cultivars and six nitrogen application**
 205 **schedules (*Pooled analysis of 2-years*)**

Treatments	Carbohydrate content (%)	Starch content (%)	Sugar content (%)
V ₁ - HM-4	70.05	64.82	1.58
V ₂ - HQPM-1	67.45	61.56	1.53
V ₃ - Azad Uttam	64.57	58.10	1.37
SEM ±	0.41	0.58	0.01
CD (p=0.05)	1.21	1.69	0.03
N ₁ - 50% B + 50% KHS	64.84	58.55	1.47
N ₂ - 50% B + 50% TE	61.76	54.96	1.39
N ₃ - 50% B + 25% KHS + 25% TE	71.57	65.64	1.56
N ₄ - 25% B + 50% KHS + 25% TE	68.06	62.23	1.48
N ₅ - 50% B + 25% KHS + 20% TE + 5% FSAFP	71.18	65.37	1.58
N ₆ - 25% B + 50% KHS + 20% TE + 5% FSAFP	66.72	62.21	1.49
SEM ±	0.58	0.81	0.01
CD (p=0.05)	1.72	2.39	0.04

206 SEM, standard error of mean

207 **3.4 Whole plant nutrient ratios**

At maturity N/P ratio varied due to cultivars only though N/K ratio affected by cultivars and nitrogen application schedules (Table 4). The overall N/P ratio began at 6.34 and ended with 6.88 for cultivars. A close relationship expressed between N and P content indicates their proportional association in baby corn. Ratio between N/P is linked with the level of N applied and biomass [28]. The N/K ratio ranged from 1.22 to 1.28 for cultivars and 1.17 to 1.32 for split nitrogen application treatments. In general, reduction in number of N application splits from four to two resulted decline in N/K ratio. At the plant level, modifications in the N/K ratio were more related to evolution in plant N and K contents and dry matter. The complex interaction between N and K has been also reported by [29].

3.5 Nutrient harvest indices

The nutrient harvest indices were evaluated (Table 4). NHI (range= 0.40 to 0.41) failed to express any variation because of cultivars and split nitrogen application. PHI (range = 0.47 to 0.52) unaffected with cultivars though, varied due to nitrogen application schedules. Maximum PHI noted with two splits (N_2) closely followed by three (N_4) and four splits (N_6). KHI (range = 0.32 to 0.33) varied due to cultivars and improved with increase in the number of splits from two to four. Highest values of nutrient harvest indices were for HM-4 while differential response observed for N application schedules. Nutrient uptake requirement estimation by the recent workers reported PHI of 0.84 and KHI of 0.17 [9] and also PHI of 0.67 and KHI of 0.25 [30].

Table 4. Plant nutrient ratios and nutrient harvest indices of baby corn evaluated at three cultivars and six nitrogen application schedules (Pooled analysis of 2-years)

Treatments	Plant nutrient ratios		Nutrient harvest indices		
	N/P ratio	N/K ratio	NHI	PHI	KHI
V ₁ - HM-4	6.34	1.28	0.40	0.49	0.33
V ₂ - HQPM-1	6.43	1.24	0.40	0.51	0.32
V ₃ - Azad Uttam	6.88	1.22	0.41	0.49	0.32
SEM ±	0.07	0.01	0.003	0.005	0.002

CD (p=0.05)	0.19	0.02	0.01	0.01	0.01
N ₁ - 50% B + 50% KHS	6.48	1.21	0.41	0.50	0.32
N ₂ - 50% B + 50% TE	6.68	1.17	0.41	0.52	0.31
N ₃ - 50% B + 25% KHS + 25% TE	6.46	1.29	0.40	0.48	0.33
N ₄ - 25% B + 50% KHS + 25% TE	6.59	1.23	0.40	0.50	0.32
N ₅ - 50% B + 25% KHS + 20% TE	6.53	1.32	0.40	0.47	0.33
+ 5% FSAFP					
N ₆ - 25% B + 50% KHS + 20% TE	6.56	1.25	0.40	0.50	0.32
+ 5% FSAFP					
SEM ±	0.09	0.01	0.004	0.007	0.002
CD (p=0.05)	0.26	0.02	0.01	0.02	0.01

227 SEM, standard error of mean

228 4. CONCLUSION

229 Study indicates hybrids (HM-4 and HQPM-1) posse's characteristics of elite cultivars and HM-4 found
230 superior thus recommended for commercial production of winter baby corn in Eastern Uttar Pradesh,
231 India. Results confirm that fraction of RDN and its application timings are important in determining the
232 yields and quality of baby corn. New approach in nitrogen management by combining soil application with
233 foliar at harvest stage had positive effect on yield of baby corn. Combined approach using three splits as
234 soil applications fb fourth split as urea foliar spray (3%) after first picking (N₅, i.e. 50% RDN as basal +
235 25% RDN at KHS + 20% RDN at TE + 5% RDN) produced higher yield attributes, yields and quality.
236 Supplementing soil nitrogen application with 5% RDN (7.5 kg ha⁻¹) as foliar spray (N₅) resulted 5.1%
237 higher baby corn yield than second best soil application treatment (N₃). Quality parameters improved by
238 nitrogen application in three splits (N₃)/four splits (N₅) compared to other N application schedules. At
239 maturity, hybrids possessed lower N/P and higher N/K ratio than composite cultivar. N/K ratio increased
240 with number of splits. Winter baby corn be grown using cultivar HM-4 adopting RDN (150 kg ha⁻¹) as soil

+ foliar application (N_s) for achieving higher yield, quality, nutrient harvest index and nutrient ratio. Further studies required for better understanding of combined approach under diverse conditions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHORS' CONTRIBUTIONS

Part of Ph.D. thesis work of author MPN carried out at Banaras Hindu University. Study area and design with data collection, lab and statistical analyses performed by the author MPN under the supervision of author SPS. Authors USS and AS helped in preparation of manuscript, graphs and statistical analysis. All authors read and approved the final manuscript.

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