Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 23(2) May-August 2025]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)

G.B. Pant University of Agriculture & Technology, Pantnagar

PANTNAGAR JOURNAL OF RESEARCH

Vol. 23(2) May-August, 2025

CONTENTS

Bioaccumulation of heavy metals in soils and *Telfairia occidentalis* leaf grown around a river bank and dump site 139
ORHUE, E. R., EMOMU, A., JUDAH-ODIA, S. A., AIGBOGHAEBHOLO, O. P. and NWAEKE, I. S.

Evaluation of maize cultivars for spring season in Indo-Gangetic plain of India 149
AMIT BHATNAGAR, N. K. SINGH and R. P. SINGH

Weed management approaches for improving maize productivity in *Tarai* Belt of India 157
AKHILESH JUYAL and VINEETA RATHORE

Effect of *Aloe vera* based composite edible coatings in retaining the postharvest quality of litchi fruits (*Litchi chinensis* Sonn.) cv. Rose Scented 163
GOPAL MANI, OMVEER SINGH and RATNA RAI

Effect of chemical treatments on seed yield and quality in parthenocarpic cucumber (*Cucumis sativus* L.) 178
DHIRENDRA SINGH and UDIT JOSHI

Assessment of chrysanthemum (*Dendranthema grandiflora* Tzvelev) varieties for their suitability for flower production under *Tarai* region of Uttarakhand 183
PALLAVI BHARATI and AJIT KUMAR KAPOOR

Population dynamics of brown planthopper and mirid bug in relation to weather factors in the *Tarai* region 194
DEEPIKA JEENGAR and AJAY KUMAR PANDEY

Influence of weather parameters on the population dynamics of Papaya mealybugs, *Paracoccus marginatus* and its natural enemies in Pantnagar, Uttarakhand 200
DIPTI JOSHI and POONAM SRIVASTAVA

***In vitro* phosphate solubilizing and phyto stimulating potential of Rhizospheric *Trichoderma* from Hilly areas of Kumaun Region** 208
DIVYA PANT and LAKSHMI TEWARI

Economics of interventions and diversifications in existing farming systems in hills of Uttarakhand 221
DINESH KUMAR SINGH, AJEET PRATAP SINGH and ROHITASHAV SINGH

Brucellosis surveillance and reproductive performance in an organized dairy herd of Uttarakhand: A seven-year retrospective analysis (2018–2024) 227
ATUL YADAV, SHIVANGI MAURYA, MAANSI and AJAY KUMAR UPADHYAY

Effects of nanosilver administration on immune responses in Wistar Rats 230
NEHA PANT, R. S. CHAUHAN and MUNISH BATRA

Antibacterial activity of Clove bud extract on MDR bacteria **240**
KANISHK A. KAMBLE, B. V. BALLURKAR and M. K. PATIL

Effect of iron oxide and aluminium oxide nanoparticles on biochemical parameters in Wistar rats **247**
NISHA KOHLI and SEEMA AGARWAL

Comprehensive case report of a mast cell tumor in a dog: clinical, cytological and histopathological analysis **257**
SWASTI SHARMA, SONALI MISHRA and GAURAV JOSHI

Evaluation of *In vitro* digestibility, functional and sensory characteristics of pre-digested corn and mungbean composite flour **261**
MANISHA RANI and ANJU KUMARI

Prevalence and public health correlates of constipation among adults in U. S. Nagar, Uttarakhand **270**
AKANKSHA SINGH, RITA SINGH RAGHUVANSHI and APURVA

Formulation and quality assessment of cheeses enriched with sapota pulp **279**
DELGI JOSEPH C. and SHARON, C. L.

Application of RSM for optimizing 7-day fermentation conditions in rice wine production **289**
RIYA K ZACHARIA, ANEENA E. R and SEEJA THOMACHAN

Investigating the mechanical properties and water absorption behavior of hemp-based natural fiber-reinforced bio-composites for humidity-resistant applications **303**
DEEPA SINGH and NEERAJ BISHT

Evaluating the performance of a forced convection solar drying system for chhurpi: A comparative analysis with traditional drying techniques **317**
SYED NADEEM UDDIN, SANDEEP GM PRASAD and PRASHANT M. DSOUZA

Digitization of G. B. Pant University Herbarium (GBPUH) and development of Virtual Herbarium Pantnagar, Uttarakhand (INDIA) **326**
RUPALI SHARMA, DHARMENDRA SINGH RAWAT and SANGEETA JOSHI

Constraints grappled with by rural communities during the implementation of Viksit Krishi Sankalp Abhiyan 2025 in Udham Singh Nagar District **332**
ARPITA SHARMA KANDPAL, B. D. SINGH, AJAY PRABHAKAR, SWATI and MEENA AGNIHOTRI

Evaluation of maize cultivars for spring season in Indo-Gangetic plain of India

AMIT BHATNAGAR[1*], N. K. SINGH[2] and R. P. SINGH[3]

[1]*Department of Agronomy,* [2]*Department of Genetics and Plant Breeding,* [3]*Department of Plant Pathology, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar-263145 (U. S. Nagar, Uttarakhand)*

[*]*Corresponding author's email id: bhatnagaramit75@gmail. com*

ABSTRACT: A field experiment was conducted at G. B. Pant University of Agriculture and Technology, Pantnagar to find out productive maize cultivars for spring season. A total 12 cultivars (Pant Sankar Makka 5, Pant Sankar Makka 6, DH 300, Dekalb 9108, P 1866, Ninja, Bisco Champion 61, P 1899, NMH 589, G-0786, AHC-1212 and Pant Sankul Makka 3) were tested in RBD with three replications. The results showed that Dekalb 9108 produced significantly more cob yield (10700 kg/ha) and grain yield (8264 kg/ha) than other cultivars but was at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6. Grain yield advantage in Dekalb 9108 was 33.5, 36.7, 38.2, 39.4, 39.9, 41.5 and 47.2%, respectively over DH 300, Pant Sankul Makka 3, Bisco Champion 61, AHC-1212, G-0786, NMH 589 and Ninja. The highest net return (₹ 126638/ha) and B:C ratio (2.21) were obtained in Dekalb 9108 which were statistically more than other cultivars but remained at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6. The study revealed that Dekalb 9108, Pant Sankar Makka 5, Pant Sankar Makka 6, P 1866 and P 1899 were productive for spring season in Indo-Gangetic plain.

Key words: Cob, corn, maize, spring, variety

Maize (*Zea mays* L.) is one of the most important cereal crops grown worldwide for food, feed, fodder and many industrial purposes. Worldwide maize is cultivated on 205 m ha area with 1163.49 m ton production (FAO, 2023). It is third most important crop after rice and wheat in India and during 2024-25 maize was grown on 10.37 m ha with production of 37.25 m ton and productivity 3472 kg/ha (Department of Agriculture & Farmers Welfare, 2024). Maize is primarily cultivated in rainy season. In north western plain zone of India where irrigation facilities are available, maize is also grown in spring season (February - June). Spring maize also has advantages of less incidence of insect pests, diseases and weeds. But spring season crops face low temperature in initial growth phase (February) and high temperature, low humidity and more evapo-transpiration during flowering and grain filling stage (April and May). Low temperature is a sever threat for spring maize in early growth stages which resulted in reduced crop growth (Bano *et al.,* 2015). This season almost remains rain free except few rains therefore cultivation is entirely dependent on irrigation. The major production constraint factors for low productivity in spring season are high temperature and more ET during reproductive phase and very low rainfall during whole crop period. The extreme weather conditions during the growing period affects growth, dry matter accumulations, assimilation reserves and partitioning to grains (Bello *et al.,* 2014). One of the key factors to harvest a good yield is appropriate selection of genotypes suited to agro-climatic conditions. Yield potential of a cultivar depends on its genetic make-up which differs with others in making effective utilization of resources and tolerance to biotic and abiotic stresses. Under same agronomic practices, the productivity of maize is largely dependent on high yielding and resilient cultivars (Wicaksana *et al.,* 2022). Hybrid maize cultivars have greater yield performance than open-pollinated cultivars (Bista *et al.,* 2021). The genotypic make-up therefore consider to be the important reason for varietal difference for productivity under same level of management. A cultivar selected for spring season should possess tolerance to low temperature during initial vegetative stage and high temperature during flowering, anthesis and grain filling period. Cultivars should also have ability to make efficient use of soil moisture and capacity to withstand low humidity coupled with high ET.

High temperature during reproductive phase in fact adversely affect pollen viability, seed set, grain filling and thus results in reduced yield (Cao *et al.,* 2024, Lohani *et al.,* 2020). The yield and growth performance of maize hybrids varies in different climatic conditions (Shrestha *et al.,* 2023). Hasan *et al.* (2025) also reported that varietal differences can significantly impact seed weight, which is crucial for overall yield potential. Pollen grains must synchronize with silks for optimal pollination, as pollen viability diminishes within 1–2 days post-anthesis, adversely affecting kernel filling and yield (Khan *et al.,* 2019). Such genetically elite maize cultivars need to be identified for complying with the existing environmental conditions of the spring season. So, the evaluation of maize cultivars in different regions is vital for assessing their yield performance. Therefore, an experiment was planned with different promising cultivars to identify suitable cultivars for spring season.

MATERIALS AND METHODS

The field experiment was conducted during the spring season, 2020 at the N. E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand representing the *Tarai* belt of Uttarakhand. It is situated at 29Ú N latitude, 79.5Ú E longitude and altitude of 243.83 m above mean sea level in the foot hills of Himalaya. The climate of the region is broadly humid sub-tropical with cool winter and hot dry summer. Weathers conditions prevalent during spring season 2020 are depicted in Fig.1. During the experiment, the maximum temperature ranged from 22.9°C (8^{th} Standard meteorological week) to 38.8°C (21^{st} Standard meteorological week) whereas the minimum temperature varied from 8.4° C (7^{th} Standard meteorological week) to 23.0° C (21^{s} Standard meteorological week). The average bright sun shine duration ranged from 6.0 hours in 8^{th} Standard meteorological week to 11.4 hours in 21^{st} Standard meteorological week. During the crop growing period, a total 198.4 mm rainfall was received with in 8 rainy days. Total evaporation was 588.7 mm.

The soil of experiment field was silty clay loam in texture, neutral in reaction (pH 7.2), medium in organic carbon (0.72%), low in available nitrogen (224 kg/ha), medium in available phosphorus (18.1 kg/ha) and medium in available potassium (204 kg/ha). The experiment consisting of twelve cultivars belong to both public and private sectors (Pant Sankar Makka 5, Pant Sankar Makka 6, DH 300, Dekalb 9108, P 1866, Ninja, Bisco Champion 61, P 1899, NMH 589, G-0786, AHC-1212 and Pant Sankul Makka 3) was conducted in Randomized Complete Block design with three replications. Crop was sown on 12 February, 2020. One pre sowing irrigation was given and the field was prepared by three harrowing and one levelling. The size of sub plot was 5.0 m × 3.6 m = 18 m^2. The furrows were opened by furrow opener at the distance of 60 cm and seeds were spaced at 25 cm with in row. A dose of 120:60:40 kg/ha $N:P_2O_5:K_2O$ was applied through NPK mixture (12:32:16), urea and muriate of potash. The 25 % of nitrogen and full dose of phosphorous and potassium was applied as basal. Remaining nitrogen was applied in 3 equal splits at 4 leaf- stage, knee height stage and at initiation of tasseling, respectively. One hoeing was done in different treatment to control weeds. One spray of chlorantraniliprole @ 0.3 ml/litre water was also made to protect the crop from infestation of fall army worm at knee height stage. The crop was irrigated seven times and depth of irrigation was 5 cm. Crop was harvested on 6 June, 2020. The plant height was measured at harvest from ground surface to the ligules of the upper most fully opened leaf. The date by which 50 per cent of the plants bear tassel and silk was recorded as date of 50 per cent tasseling and 50% silking. Anthesis silk interval (ASI) was calculated by taking difference between days to 50% silking and days to 50% tasseling in respective treatments. The number of days between sowing date and harvesting date were counted and reported as crop duration in days. At the time of harvest, the number of plants and cobs in each net plot were counted and were expressed on hectare basis. Five cobs were randomly selected from each net plot. The husk was removed and their length was measured with the help of measuring scale. The cobs selected for measuring cob length were also used for recording cob girth. The girth was measured at three points i. e. bottom, middle and top of the cob. The average of these three values was expressed as cob girth. The cobs were harvested manually and were shelled when grain moisture content was about 15 per cent. Production efficiency was calculated by dividing grain yield (kg/ha) by duration of cultivar (days). Irrigation water use efficiency was computed by dividing grain yield (kg/ha) by total depth of irrigation (cm). The economics was computed considering inputs cost and minimum support price of maize grain prevailed during year 2024. Net returns were calculated by deducting the cost of cultivation from the gross returns. The benefit to cost ratio (B: C) was worked out by dividing net returns from cost of cultivation. The data obtained from various observations were statistically analyzed as per procedure of Randomized Block Design by using the standard techniques of Analysis of Variance (Gomez and Gomez, 1984). Treatment means were compared at 5% level of significance.

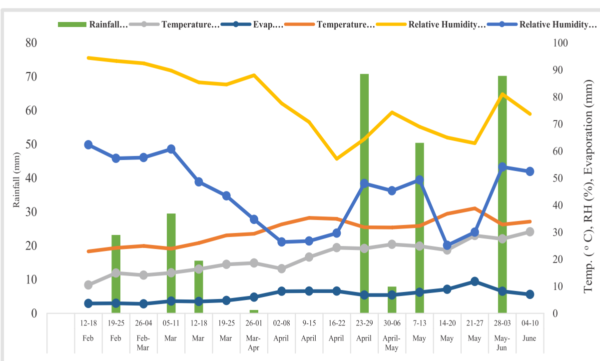

Fig.1: Weather parameters during spring 2020

RESULTS AND DISCUSSION

Plant population and number of cobs

Plant population varied from 60.7 to 66.2 thousand/ha but differences were non-significant among cultivars. Similarly, number of cobs/ha were non-significant (Table 1). All cultivars were sown at recommended planting geometry so variations in plant population did not vary significantly. Since number of cobs depends plant population hence at par differences in number of cobs/ha were also recorded. Uniform plant population among various maize hybrids was also reported by Ali *et al*. (2020).

Plant height

Plant height was maximum (156.8 cm) in Bisco Champion 61 which was significantly superior to Pant Sankar Makka 6, DH 300, AHC-1212 and Pant Sankul Makka 3 (Table 1). The significant effect may be due to the high responsiveness of different cultivars to available growth factors, viz, nutrient, solar radiation and moisture (Jami *et al.,* 2017). More plant height of hybrids indicates its potential for better light capture and enhanced photosynthesis, which are essential for maximizing yield (Shrestha *et al.,* 2023).

Days to 50% flowering and ASI

Significant differences were recorded for days to 50% tasseling and days to 50% silking among different cultivars (Table 1). Cultivar G-0786 had maximum days to reach 50% tasseling and 50% silking stage (76.0 and 79.0 days, respectively) while Bisco Champion 61 took minimum days (70.7 and 74.7 days, respectively). Anthesis silk interval (ASI) varied significantly from 3.0 days (DH 300, Dekalb 9108, G-0786 and AHC-1212) to 4.0 days (Pant Sankar Makka 5, Pant Sankar Makka 5, Bisco Champion 61, P 1899 and Pant Sankul Makka 3). Genotypic differences caused variation in days to 50% flowering. These findings align with Thapa *et al.* (2022), who reported significant differences in anthesis among maize hybrids.

Cob length and cob girth

Among cultivars, Dekalb 9108 being at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6 attained significantly more cob length (15.7 cm) and cob girth (14.1 cm) than others (Table 1**).** Genetic makeup and expression of genes are responsible for growth and development of plant under specific environment conditions. Significant differences among different hybrids for cob characteristics were due to their genotypic differences. The variations in cob girth and cob length among hybrids were due to genetically induced variation (Khedwal *et al.,* 2018; Coelho *et al.,* 2020). Significant variations in cob

Table 1: Growth and yield attributes of maize cultivars in spring season

Treatment	Plants (×10³) /ha	Cobs (×10³)/ ha	Plant height (cm)	Days to 50% tasseling	Days to 50% silking	ASI (days)	Cob length (cm)	Cob girth (cm)	100-grain weight (g)	Grain weight/ cob (g)
Pant Sankar Makka 5	64.4	64.4	149.8	73.7	77.7	4.0	15.2	13.7	27.5	112.7
Pant Sankar Makka 6	63.0	63.0	147.4	71.0	74.7	3.7	15.2	13.7	27.7	117.8
DH 300	61.5	61.5	144.3	75.0	78.0	3.0	14.6	12.9	23.8	101.9
Dekalb 9108	61.0	61.0	156.2	71.0	74.0	3.0	15.7	14.1	28.6	130.0
P 1866	63.7	63.7	154.7	69.0	73.0	4.0	15.4	13.9	28.4	125.5
Ninja	64.2	64.2	152.9	75.0	78.0	3.0	13.6	12.2	23.3	90.4
Bisco Champion 61	66.2	66.2	156.8	70.7	74.7	4.0	14.6	13.2	24.3	94.9
P 1899	60.7	60.7	153.9	74.0	78.0	4.0	15.2	13.7	27.6	116.3
NMH 589	63.0	63.0	152.4	73.0	76.3	3.3	13.6	12.3	23.6	92.6
G-0786	63.2	63.2	153.4	76.0	79.0	3.0	13.6	12.4	23.8	91.9
AHC-1212	63.5	63.5	142.4	69.0	72.0	3.0	13.5	12.3	23.4	96.4
Pant Sankul Makka 3	63.2	63.2	139.6	66.3	70.3	4.0	13.7	12.4	23.8	96.6
SEm±	1.5	1.5	3.0	0.2	0.2	0.1	0.2	0.2	0.5	7.1
CD (5%)	NS	NS	8.9	0.5	0.6	0.4	0.6	0.6	1.4	20.8

Table 2: Yield, water use efficiency and B:C of maize cultivars in spring season

Treatment	Cob yield (kg/ha)	Grain yield (kg/ha)	Shelling (%)	Stover yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Irrigation water use efficiency (kg/ha-cm)	B:C ratio
Pant Sankar Makka 5	9543	7243	75.8	11926	21469	33.7	206.9	1.82
Pant Sankar Makka 6	9744	7328	75.2	11852	21596	34.0	209.4	1.85
DH 300	8257	6189	75.0	11630	19887	31.1	176.8	1.41
Dekalb 9108	10700	8264	77.2	13704	24404	33.9	236.1	2.21
P 1866	10620	8159	76.9	13333	23953	34.1	233.1	2.17
Ninja	7379	5613	76.0	9333	16713	33.6	160.3	1.18
Bisco Champion 61	8002	5978	74.7	9778	17780	33.7	170.8	1.32
P 1899	9851	7395	75.1	11407	21259	34.8	211.3	1.87
NMH 589	7740	5841	75.4	9629	17369	33.6	166.9	1.27
G-0786	7941	5905	74.4	9926	17867	33.2	168.7	1.29
AHC-1212	7833	5926	75.8	9852	17684	33.4	169.3	1.30
Pant Sankul Makka 3	8036	6047	75.2	10222	18258	33.0	172.8	1.35
SEm±	509	382	0.8	553	722	1.6	10.9	0.15
CD (5%)	1504	1129	NS	1633	2131	NS	32.2	0.44

length among maize genotypes were also reported by Maruthi and Rani (2015).

100-grain weight

Significantly more 100-grain weight (28.6 g) was recorded in Dekalb 9108 which was at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6. Significantly lower weight was in Ninja (23.3 g). Differences in 100-grain weight may be attributed to genotypic variations in translocation efficiency of photosynthates from source to sink. Grain weight is a genetically controlled factor and thus variations in 100-grain weight among different maize hybrids were recorded (Ali *et al.,* 2020). These results are also in conformity with the findings of Magashi *et al.* (2015).

Grain weight/ cob

Grain weight/cob varied significantly where Dekalb 9108 had significantly more value (130 g) than other cultivars but remained at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6 (Table 1). Minimum grain weight/cob (90.4 g) was recorded in Ninja followed by G-0786. Variations in grain weight/ cob among cultivars was due to differences in cob length cob girth and 100-grain weight. A similar result was also obtained by Duchok *et al*. (2021).

Cob and grain yield

Dekalb 9108 produced significantly more cob yield (10700 kg/ha) and grain yield (8264 kg/ha) than other cultivars but remained at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6 (Table 2). The yield advantage in Dekalb 9108 was 33.5, 36.7, 38.2, 39.4, 39.9, 41.5 and 47.2% over DH 300, Pant Sankul Makka 3, Bisco Champion 61, AHC-1212, G-0786, NMH 589 and Ninja, respectively. Yield attributes such as cob length, cob girth and 100-grain weight directly contribute to cob and grain yield. Significant differences in such yield attributes led to statistical differences in cob yield. Raut *et al*. (2017) and Bista *et al*. (2021) noticed significant differences for yield attributing traits among genotypes which strongly support the present finding. Grain yield of maize depends on number of cobs per unit area and grain weight per cob. In this study number of cobs/ha were at par but grain weight/cob varied significantly. Therefore, differences in grain yield were due to significant variation in yield attributes such as cob length, cob girth and 100-grain weight. Thapa *et al*. (2022) also reported that cob length is a direct contributor to grain yield. Dekalb 9108, P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6 had higher value of grain weight/cob as a result of more cob length, cob girth and 100-grain weight than other hybrids and therefore recorded more grain yield. These results confirm the findings of Khan *et al*. (2019).

Stover Yield

Dekalb 9108 being at par with P 1866 recorded significantly more stover yield (13704 kg/ha) than other cultivars (Table 2). Significantly lower stover yield was noted in Ninja followed by NMH 589. The variation in stover yield was due to varietal differences (Jami *et al.,* 2017).

Biological yield

Maximum biological yield (24404 kg/ha) was obtained in Dekalb 9108 which was significantly higher than other cultivars except P 1866 (Table 2). Biological yield was minimum in Ninja (16713 kg/ha) followed by NMH 589. Biological yield is sum total of cob yield and stover yield. Cultivars which produced significantly more cob and stover yield had significantly more biological yield. These results agree with Bishta *et al*. (2021).

Shelling percentage

Data presented in Table 2 show that shelling ranged from 74.4% in G-0786 to 77.2% in Dekalb 9108 but cultivars failed to show statistical differences. Non significant differences in shelling percentage indicated that ratio of grain to cob was same in all cultivars.

Harvest index

Harvest index is the ratio of grain yield to biological yield. It tells the photosynthetic efficiency of a crop for transformation of assimilates into the economic yield. Data in the Table 2 indicated that different cultivars responded non significantly for harvest index. These results are in agreement with those of Ali *et al*. (2020) who reported that harvest index was non-significant among maize hybrid.

Production efficiency

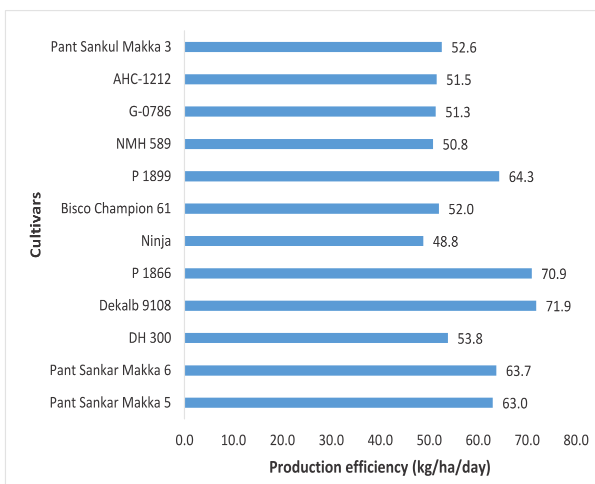

Fig.2: Production efficiency of maize cultivars in spring season

Fig.2 elucidated production efficiency of different cultivars in spring season. Data revealed that Dekalb 9108 being at par with P 1866 P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6 had significantly more production efficiency (71.9 kg/ha/day) than other cultivars. The lowest production efficiency was noted in Ninja (48.8 kg/ha/day). Production efficiency is ratio between yield and crop duration which is affected directly by grain yield and inversely by duration of crop. Every cultivar had same duration (115 day) because sowing and harvesting dates were same for all cultivars but these varied for grain yield. Thus, only differences in grain yield caused variation in production efficiency. Olasehinde *et al*. (2023) also noted differences in production efficiency of different maize cultivars.

Water use efficiency

Crop faced high temperature and high ET with low rains during late vegetative phase and reproductive stage. These factors led to more irrigation requirement. Significantly more irrigation water use efficiency (236.1 kg/ha-cm water) was noted in Dekalb 9108 which was at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6. (Table 2). The lowest irrigation water use efficiency was recorded in Ninja (160.3 kg/ha-cm water). Irrigation water use efficiency is directly related to grain yield and inversely with amount of irrigation water applied. All cultivars were irrigated equal in frequency (7 times) and with same depth of irrigation (5 cm).

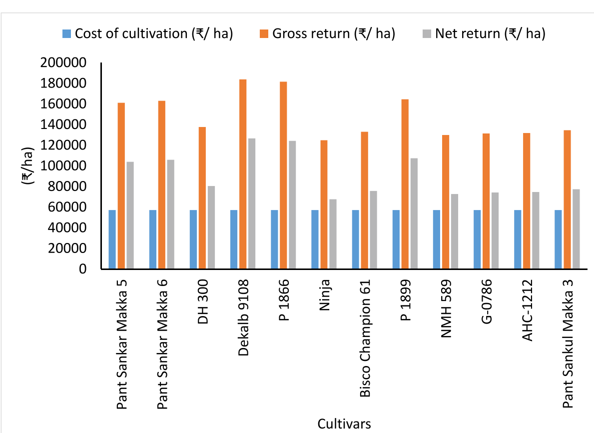

Fig.3: Economics of maize cultivars in spring season

Thus, amount of water application in all cultivars was equal i. e., 35 cm. Therefore, cultivars with more grain yield attained more irrigation water use efficiency. These results are in the lines of Fandika *et al*. (2020).

Economics

The cost of cultivation was same (₹ 57238/ha) in all hybrids because of same level of inputs (Fig.3). Gross return followed the trend of grain yield and significantly more gross return was recorded in Dekalb 9108 (₹183876/ha) followed by P 1866 (₹ 181536/ha). The highest net return (₹126638/ha) and B:C ratio (2.21) were also obtained in Dekalb 9108 which were statistically more than other cultivars but were at par with P 1866, P 1899, Pant Sankar Makka 5 and Pant Sankar Makka 6. The monetary advantage in Dekalb 9108 over DH 300, Pant Sankul Makka 3, Bisco Champion 61, AHC 1212, G-0786, NMH 589 and Ninja was ₹46160, 49330, 50786, 52024, 52500, 53926 and 58989/ha, respectively. The lowest net return and B:C were obtained in Ninja. Differences in gross and net return were due to differences only in grain yield because cost of cultivation was same in all cultivars. Cultivars with more net return had higher value of B:C.

CONCLUSION

The productivity and profitability of Dekalb 9108 were the highest in spring season and this cultivar was at par with Pant Sankar Makka 5, Pant Sankar Makka 6, P 1866 and P 1899. Based on this study these promising cultivars may be suggested for cultivation in spring season in Indo-Gangetic plain.

REFERENCES

Ali, A., Adnan, M., Abbas, A., Javed, M. A., Safdar, M. E., Asif, M., Imran, M., Iqbal, T., Rehman, F. and Ahmad, R. (2020). Comparative performance of various maize (*Zea mays* L.) cultivars for yield and related attributes under semi-arid environment. *Agricultural and Biological Research*, 36 (4): 63-66.

Bano, S., Aslam, M., Saleem, M., Basra, S. and Aziz, K. (2015). Evaluation of maize accessions under low temperature stress at early growth stages. *The Journal of Animal & Plant Sciences,* 25 (2): 392-400.

Bello, O. B., Olawuyi, O. J., Abdulmaliq, S. Y., Ige, S. A., Mahamood, J., Azeez, M. A. and Afolabi, M. S. (2014). Yield and disease reactions of quality protein maize cultivars in the Southern Guinea Savanna Agro-Ecology of Nigeria. *Sarhad Journal of Agriculture,* 30 (1): 53-66.

Bista, K., Gaire, R. and Devkota, K. (2021). Evaluation of open-pollinated and hybrid maize cultivars in the spring season at Baitadi district, Nepal. *SAARC Journal of Agriculture*, 19 (2): 123-136.

Cao, Z., Chen, Z., Tang, B., Zeng, Q., Guo, H., Huang, W., Luo, Y., Shen, S. and Zhou, S. (2024). The effects of sowing date on maize: Phenology, morphology, and yield formation in a hot subtropical monsoon region. *Field Crops Research*, 309: 109309.

Coelho A. E., Sangoi, L., Junior, A. A. B., Fioreze, S. L., Berghetti, J., Kuneski, H. F., Leolato, L. S. and Junior, M. C. M. (2020). Growth patterns and yield of maize (*Zea mays*) hybrids as affected by nitrogen rate and sowing date in southern Brazil. *Crop and Pasture Science*, 71: 976–986.

Department of Agriculture & Farmers Welfare. (2024). Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001 www. agriwelfare. gov. in.

Duchok, M., Bhuyan, T., Devadas, V. S., Monlai, S. and Sharma, A. (2021). Response of different maize (*Zea mays* L.) varieties to planting densities. *International Journal of Current Microbiology and Applied Sciences*, 10 (2): 1278-1284.

Fandika, I. R., Chipula, G. and Mwepa, G. (2020). Water use efficiency differences in maize varieties under every furrow and alternate furrow irrigation. *Sustainable Agriculture Research*, 9 (2): 17-29.

FAO (2023). FAOSTAT: Production: Crops and livestock products. https://www. fao. org/faostat/en/#data/QCL.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research.2nd Edition, John Wiley and Sons, New York, 680 p.

Hasan, N., Jone, M. J. H., Das, B., Siddique, M. N. A., Islam, Y. and Kashem, M. A. (2025). Genetic parameter analysis and evaluation of maize hybrids under local climatic condition of Mymensingh, Bangladesh. *Heliyon*, 11 (1): e41481.

Jami, N. N., Singh, P. L. and Nongmaithem, D. (2017). Yield response of maize (*Zea mays* L.) cultivars under rainfed condition. *International Journal of Bio-resource and Stress Management*, 8 (2): 187-190.

Khan, M. U., Shah, S. M. A., Rahman, H., Iqbal, A. and Aslam, E. (2019). Evaluation of maize hybrids for yield and maturity traits. *Sarhad Journal of Agriculture*, 35 (1): 7-12.

Khedwal, R. S., Yadav, D. B. and Hooda, V. S. (2018). Crop residue management in no-till maize: Influence the growth, yield and economics of *kharif* maize (*Zea mays* L.). *Forage Research*, 44 (2): 90–95.

Lohani, N., Singh, M. B. and Bhalla, P. L. (2020). High temperature susceptibility of sexual reproduction in crop plants. *Journal of Experimental Botany*, 71 (2): 555–568.

Maruthi, R. T. and Rani, K. J. (2015). Genetic variability, heritability and genetic advance estimates in maize (*Zea mays* L.) inbred lines. *Journal of Applied and Natural Science*, 7 (1): 149-154.

Magashi, A. I., Sarkin, F. M., Jari, S., Sadiq, B. (2015). Evaluation of different maize cultivars (*Zea mays* L.) for drought tolerance in relation to root and yield parameters in Gaya LGA Sudan Savannah. *International Journal of Chemical, Environmental and Biological Sciences*, 3 (1): 64-66.

Olasehinde, T. S., Qiao, F. and Mao, S. (2023). Impact of improved maize cultivars on production efficiency in Nigeria: separating technology from managerial gaps. *Agriculture*, 13 (3): 611 https://doi. org/10.3390/agriculture13030611.

Raut, S. K., Ghimire, S. K., Kharel, R., Kuwar, C. B., Sapkota, M. and Kushwaha, U. K. (2017). Study of yield and yield attributing traits of Maize. *American Journal of Food Science and Health,* 3 (6): 123-129.

Shrestha, S., Niraula, D., Regmi, S., Basnet, S., Chhetri, S. T. and Kandel, B. P. (2023). Performance evaluation and genetic parameters estimation of multi-companies maize hybrids in Lamahi Dang, Nepal. *Heliyon*, 9 (3): e14552.

Thapa, S., Rawal, S. and Adhikari, S. (2022). Varietal evaluation of hybrid maize in the summer and winter seasons in terai region of Nepal. *Heliyon*, 8 (11): e11619.

Wicaksana, N., Maulana, H., Yuwariah, Y., Ismail, A., Ruswandi, Y. A. R. and Ruswandi, D. (2022). Selection of high yield and stable maize hybrids in mega-environments of Java Island, Indonesia. *Agronomy*, 12 (12): 2923. https://doi. org/10.3390/agronomy12122923.

Received: May 15, 2025
Accepted: July 26, 2025