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Jitendra Kumar Dubey
Ph.D., Department of Natural
Resource Management, Faculty
of Agriculture, Mahatma Gandhi
Chitrakoot Gramodaya
Vishwavidyalaya Chitrakoot,
Satna, Madhya Pradesh, India

HS Kushwaha
Professor, Department of
Agronomy, Mahatma Gandhi
Chitrakoot Gramodaya
Vishwavidyalaya Chitrakoot,
Satna, Madhya Pradesh, India

Amit Kumar Jha
Assistant Professor, Department
of Agronomy, Faculty of
Agriculture, Mahatma Gandhi
Chitrakoot Gramodaya
Vishwavidyalaya Chitrakoot,
Satna, Madhya Pradesh, India

Corresponding Author
Jitendra Kumar Dubey
Ph.D., Department of Natural
Resource Management, Faculty
of Agriculture, Mahatma Gandhi
Chitrakoot Gramodaya
Vishwavidyalaya Chitrakoot,
Satna, Madhya Pradesh, India

Growth and biomass productivity of maize as influenced by maize cultivars and maize based cropping system

Jitendra Kumar Dubey, HS Kushwaha and Amit Kumar Jha

Abstract

A field experiment was conducted during 2017-18 and 2018-19 at Research Farm, JNKVV Jabalpur (M.P.) to assess the growth and biomass productivity of maize cultivar under maize based cropping systems. The growth parameters *viz.* plant height and dry weight/plant were recorded significantly higher under maize (composite) - chickpea followed by maize (composite) - field pea and maize (composite) - berseem treatment while, leaves/plant was noted significantly more under maize (hybrid) in maize (hybrid)-chickpea and maize (hybrid) - field pea during two years. The maize (hybrid) fb chickpea treatment recorded significantly higher grain yield followed by Maize (hybrid) – field pea and maize (hybrid) - berseem during two years. The significantly higher biomass productivity was recorded under maize (hybrid) fb chickpea followed by maize (hybrid)-field pea and maize (hybrid) - berseem during both the years.

Keywords: Growth parameters, cropping systems, biomass productivity, maize

Introduction

Maize (*Zea mays* L.) is one of the most important cereal grains grown worldwide in a wider range of environment because of its greater adoptability. It is one of the most important cereal crops next to wheat and rice in the world (Begum *et al.*, 2018) [5]. In India, maize was grown in an area of 7.467 million hectare, production of 18.786 million tonnes and productivity of 2516 kg/ha (Anonymous, 2021) [1]. The crop has tremendous genetic variability, which enables to thrive in tropical, subtropical, and temperate climates. As maize has wide adoptability and compatibility under diverse soil and climatic conditions, hence it is considered as one of the potential drivers of crop diversification under different situations and is cultivated in sequence with different crops under various Agro-ecologies of the country. However in *rabi* season, there are various crops *i.e.* wheat, gram, mustard, pea etc. are growing by farmers. Among the maize base cropping system, maize-wheat, maize-mustard, maize-berseem system have gained much popularity amongst the farming community. The Kymore Plateau of Madhya Pradesh is a potential area for maize and soybean crop cultivation. Therefore a need to develop maize based cropping system, which can give higher productivity. Hence keeping in above view and facts, the present study was under taken to identify best maize cultivar and superior maize based cropping systems which improve the productivity and resource use efficiency.

Material and Methods

A field experiment was conducted during 2017-18 and 2018-19 at Research Farm, Department of Agronomy, JNKVV, Jabalpur Adhartal to assess the growth and biomass productivity of maize under maize based cropping systems. The climate of this region is typically semi-arid and sub-tropical having extreme winter and summer. The average annual rainfall is 1350 mm, which was received 876.6 mm and 555.6 mm from June to March during two consecutive years of experimentation. The topography of the field was uniform with proper drainage. The soil of the experimental field was clay loam in texture however, the available N, P, K and organic carbon content in the soil were 254 kg/ha, 17.15 kg/ha, 319.20 kg/ha and 0.48%, respectively. The soil was nearly neutral reaction having pH 7.23. The experiment comprised 12 cropping treatment *viz* two maize cultivars (composite and hybrid) and 6 cropping system *viz.* maize (composite) - wheat, maize (composite) - mustard, maize (composite) - berseem, maize (composite) - chickpea, maize (composite) - field pea, maize (composite) - lentil and maize (hybrid) - wheat, maize (hybrid) - mustard, maize (hybrid) - berseem, maize

(hybrid)- chickpea, maize (hybrid)-field pea, maize (hybrid)-lentil systems were tried in a randomized block design (RBD) and three replication. The maize crop sown on 25/06/2017 and 29/06/2018 with seed rate of 20 kg/ha of spacing 45 cm X20 cm during two consecutive years. Maize crop was harvested on 04/10/2017 and 10/10/2018 during two respective years. The maize crop (composite, hybrid) was applied 100:60 and 40 kg/ha NPK which gave 1/3 nitrogen with full dose of phosphorus and potassium as basal and remaining 2/3 nitrogen equally apply in two split dose at 30 and 50 DAS, Maize crop was grown as per recommended package of practices. However, the observation was noted as per standard procedure. The biomass productivity was calculated in term of biological yield of maize crop. Data generated were subjected to analysis of variance (ANOVA) and Critical Difference (CD) at 5% probability level was obtained (Gomez and Gomez, 1984)^[3].

Results and Discussion

Growth parameter of maize

Growth parameters of maize *viz.* plant height (281.33 cm and 285.67 cm) and dry weight/plant (57.39 g and 59.01 g) were recorded higher under maize (composite) fb chickpea (T₂) treatment; which was at par with rest of the composite maize based cropping systems and significantly higher over hybrid maize based cropping systems. It might be due to lower competition *i.e.* plant attained height and properly utilized solar radiation and nutrient and synthesized higher dry weight /plant Similar findings were reported by Nyasasi and Kisetu

(2014)^[4]. While, maximum number of leaves/plant (17.89 and 18.56) was registered under maize (hybrid) fb chickpea (T₈) which was at par with rest of the hybrid maize based cropping systems during 2017-18 and 2018-19. These results are in accordance with the results of Bhat *et al.* (2013)^[8], Parimaladevi *et al.* (2019)^[7] and Yamuna *et al.* (2015)^[2].

Yield

Grain and straw yield of maize was obtained significantly superior in maize (hybrid)- chickpea (6316 and 6532 kg/ha; 9065 and 9099 kg/ha) closely followed by maize (hybrid)-field pea (6291 and 6497 kg/ha; 9044 and 9084 kg/ha) and maize (hybrid)- berseem (6274 and 6476 kg/ha; 9017 and 9064 kg/ha) during two consecutive years. This could be ascribed due to greater value of growth parameters *viz.* leaves /plant and yield attributes. The results are in accordance with findings of Uzoh *et al.* (2019)^[10].

Biomass productivity

The significantly greater biomass productivity (15381 kg/ha and 15631 kg/ha) was recorded under maize (hybrid) fb chickpea (T₈) treatment which was statistically at par with rest of the hybrid maize based cropping systems and significantly higher over composite maize based cropping systems during 2017-18 and 2018-19. The treatment maize (hybrid) fb field pea (T₁₀) and maize (hybrid) fb berseem (T₁₁) produced intermediate order of biomass production. This could be ascribed due to higher value of grain and stover yield of maize.

Table 1: Effect of maize cultivar and maize based cropping system on growth parameters of maize

Treatment	Plant height (cm)		No of leaves/plant		Dry weight/plant (g)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Maize (Composite) fb Wheat	279.00	283.67	17.00	17.89	56.92	57.94
Maize (Composite) fb Chickpea	281.33	285.67	17.89	18.56	57.39	59.01
Maize (Composite) fb Mustard	279.55	284.33	17.11	18.00	57.03	58.06
Maize (Composite) fb Field pea	281.00	285.00	17.59	18.44	57.32	58.19
Maize (Composite) fb Berseem	280.33	284.67	17.55	18.33	57.19	58.81
Maize (Composite) fb Lentil	280.00	284.44	17.45	18.22	57.12	58.08
Maize (Hybrid) fb Wheat	247.33	249.00	20.00	20.33	50.36	50.77
Maize (Hybrid) fb Chickpea	249.00	252.00	20.89	21.44	50.80	51.43
Maize (Hybrid) fb Mustard	247.00	249.56	20.11	20.44	50.39	50.91
Maize (Hybrid) fb Field pea	248.67	251.56	20.67	21.22	50.73	51.34
Maize (Hybrid) fb Berseem	248.00	250.78	20.56	21.00	50.59	51.18
Maize (Hybrid) fb Lentil	247.67	250.00	20.44	20.89	50.52	51.02
S.Em±	6.21	6.85	0.45	0.36	1.27	1.33
CD (P=0.0 5)	18.21	20.08	1.33	1.06	3.72	3.90

Table 2: Effect of maize cultivar and maize based cropping system on yield and biomass productivity of maize

Treatment	Grain yield (kg/ha)		Straw yield (kg/ha)		Biomass productivity (kg/ha)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Maize (Composite) fb Wheat	3859	3912	6867	7074	10726	10986
Maize (Composite) fb Chickpea	3940	3978	6966	7182	10906	11160
Maize (Composite) fb Mustard	3869	3927	6882	7090	10751	11017
Maize (Composite) fb Field pea	3928	3959	6941	7163	10869	11122
Maize (Composite) fb Berseem	3900	3964	6905	7138	10805	11102
Maize (Composite) fb Lentil	3880	3939	6896	7114	10776	11053
Maize (Hybrid) fb Wheat	6208	6418	8955	9005	15163	15423
Maize (Hybrid) fb Chickpea	6316	6532	9065	9099	15381	15631
Maize (Hybrid) fb Mustard	6226	6438	8973	9027	15199	15465
Maize (Hybrid) fb Field pea	6291	6497	9044	9084	15335	15581
Maize (Hybrid) fb Berseem	6274	6476	9017	9064	15291	15540
Maize (Hybrid) fb Lentil	6257	6461	9003	9047	15260	15508
S.Em±	123	106	169	148	292	254
CD (P=0.0 5)	360	311	494	435	854	746

Conclusion

Thus, it can be concluded that maize (hybrid) fb chickpea, maize (hybrid) fb field pea and maize (hybrid) fb berseem were found most productive cropping system for higher biomass production of maize under Kymore Plateau region of Madhya Pradesh.

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