

Yield and economics of maize under maize-based cropping system in Kymore Plateau of Madhya Pradesh

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Received: May 2022; Revised Accepted: October 2022

ABSTRACT

A field experiment was conducted in a clay loam texture soil during 2017-18 and 2018-19 at Research Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) to study the yield and economics of maize cultivars under maize based cropping systems in Kymore Plateau of Madhya Pradesh. The grain and straw yield was recorded significantly superior under maize (hybrid) - chickpea (6316 and 6532 kg/ha; 9065 and 9099 kg/ha) 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 respective years. Significantly maximum HI was assessed under maize (hybrid) - chickpea (41.09 and 41.79 %) followed by maize (hybrid)-field pea (41.03 and 41.70 %) and maize (hybrid) - berseem (41.02 and 41.68 %). Significantly maximum harvest index was assessed under maize (hybrid) - chickpea (41.09 and 41.79 %) followed by maize (hybrid)-field pea (41.03 and 41.70 %) and maize (hybrid) - berseem (41.02 and 41.68 %). Net returns was recorded significantly greater under maize (hybrid)-chickpea (₹66127/ha) followed by maize (hybrid)-field pea (₹65740/ha) and maize (hybrid) - berseem (₹65473/ha). However, B:C ratio was obtained maximum under maize (hybrid) -chickpea (2.69) followed by maize (hybrid)-field pea (2.67) and maize (hybrid) - berseem (2.66).

Key words: Cropping system, economics, maize, yield.

Maize (*Zea mays* L.) is one of the most important cereal crop grown worldwide. It has wide adaptability 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. Pulses in the maize based cropping system can maintain soil fertility and sustain crop productivity, but keeping in view the need for providing nutritious fodder for in-

creased livestock population and also the need for edible oil for domestic consumption; maize-wheat, maize-mustard, maize-berseem cropping system have gained much popularity amongst the farming community. Such a scenario demands, addition of plant nutrients to soil in excess than their removal by the cropping system for maintaining the soil health. Kymore Plateau is a potential area for maize and soybean crop cultivation. However, in *rabi* season, there are various crops i.e., wheat, chickpea, mustard, pea etc. are growing by farmers. Therefore, there is 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

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based cropping systems for higher yield and profitability of maize.

MATERIALS AND METHODS

A field experiment was conducted during 2017-18 and 2018-19 at Research Farm, Department of Agronomy, JNKVV, Jabalpur (M.P.) India to assess the yield and economics 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, while it 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, 17.1 kg/ha, 319.2 kg/ha and 0.48%, respectively. The soil was nearly neutral reaction having pH 7.23. The experiment comprised of 12 treatment combination *viz* two maize cultivars (composite and hybrid) and 6 cropping systems *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) with

three replications. The maize crop was sown on 25/06/2017 and 29/06/2018 with seed rate of 20 kg/ha of spacing 45 cm × 20 cm during two consecutive years. Maize crop was harvested on 04/10/2017 and 10/10/2018 during two respective years. The RDF of maize 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. Data generated were subjected to analysis of variance (ANOVA) and Critical Difference ($P=0.05\%$) probability level (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Yield

The grain yield of maize was recorded significantly maximum under maize (hybrid) fb chickpea (6316 kg/ha and 6532 kg/ha) followed by maize (hybrid)-field pea (6251 and 6497 kg/ha) and maize (hybrid)-berseem (6274 and 6476 kg/ha). However, stover yield was obtained significantly superior under maize (hybrid) fb chickpea treatment (9065 kg/ha and 9099 kg/ha) followed by maize (hybrid)-field pea (9044 and 9084 kg/ha) and maize (hybrid)-berseem (9017 and 9064 kg/ha) during two years. This might be due to lesser competition between the crop plants

Table 1. Yield and harvest index of maize cultivar as influenced by maize-based cropping system

Treatments	Grain yield (kg/ha)		Straw yield (kg/ha)		Harvest Index (%)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Maize (Composite) fb Wheat	3859	3912	6867	7074	35.98	35.62
Maize (Composite) fb Chickpea	3940	3978	6966	7182	36.22	35.65
Maize (Composite) fb Mustard	3869	3927	6882	7090	35.99	35.65
Maize (Composite) fb Field pea	3928	3959	6941	7163	36.15	35.60
Maize (Composite) fb Berseem	3900	3964	6905	7138	36.09	35.71
Maize (Composite) fb Lentil	3880	3939	6896	7114	36.01	35.67
Maize (Hybrid) fb Wheat	6208	6418	8955	9005	40.95	41.63
Maize (Hybrid) fb Chickpea	6316	6532	9065	9099	41.09	41.79
Maize (Hybrid) fb Mustard	6226	6438	8973	9027	40.98	41.65
Maize (Hybrid) fb Field pea	6291	6497	9044	9084	41.03	41.70
Maize (Hybrid) fb Berseem	6274	6476	9017	9064	41.02	41.68
Maize (Hybrid) fb Lentil	6257	6461	9003	9047	41.01	41.67
SEm±	123	106	169	148	0.96	0.81
CD (P=0.05)	360	311	494	435	2.81	2.37

during crop growth period which leads to more accumulation of photosynthesis in sink and, resulted superior grain as well as stover yield of maize. This could be explained due to the fact that the higher growth and yield attributing parameters of maize under aforesaid maize based cropping system, produced the superior grain and stover yield and increased nutrient uptake by the maize appears to be directly related to the greater availability of soil nutrient possibly resulting from the decomposition of the incorporated legumes residue. Organic matter content from the decomposing legume residues could have improved the chemical properties of the soil important to good plant growth. Improved soil properties such as water holding capacity, cation exchange capacity and mineralization of other plant nutrients could have also contributed to the increased maize yields apart from the increased soil nutrient availability. The results are in agreement with the findings of Uzoh *et al.* (2019) and Sarkar *et al.* (2018).

Harvest Index

Maximum harvest index (41.09 and 41.79 %) was estimated significantly higher under Maize (Hybrid) - Chickpea (T_8) followed by maize (hybrid) - field pea (41.03 and 41.70 %) during two consecutive years. It might be due to more accumulation of photosynthesis in sink in the form of grain than that of stover in hybrid maize as compared to composite maize. Assessment of dry matter production and its distribution in various parts was also important for the determination of total seed yield of the crop. Dry matter production is an important pre-requisite for higher yields as it signifies photosynthetic ability of the crop and also indicates other synthetic processes during developmental sequences (Kumar *et al.*, 2020)

Economics

Maximum value gross monetary returns (₹90711/ha) was assessed significantly higher under maize (hybrid) *fb* chickpea treatment which was at par with maize (hybrid)- field pea (₹90324/ha) and maize (hybrid) - chickpea (₹90057/ha) based cropping systems. However, higher net returns value (₹66127/ha) was obtained significantly superior under maize (hybrid) *fb* chickpea treatment over composite maize based cropping sys-

Table 2. Economics of maize cultivar as influenced by maize-based cropping system

Treatments	Cost of cultivation (₹/ha)			Gross monetary returns (₹/ha)			Net monetary returns (₹/ha)			B:C ratio	
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	Pooled
Maize (Composite) <i>fb</i> Wheat	24250	24250	24250	56608	57551	57080	32558	33301	32830	1.35	1.35
Maize (Composite) <i>fb</i> Chickpea	24250	24250	24250	57729	58510	58119	33470	34250	33114	1.40	1.40
Maize (Composite) <i>fb</i> Mustard	24250	24250	24250	56755	57764	57259	32505	33514	33009	1.36	1.36
Maize (Composite) <i>fb</i> Field pea	24250	24250	24250	57547	58256	57902	33297	34006	33652	1.39	1.39
Maize (Composite) <i>fb</i> Berseem	24250	24250	24250	57157	58275	57716	32907	34025	33466	1.38	1.38
Maize (Composite) <i>fb</i> Lentil	24250	24250	24250	56908	57935	57422	32698	33685	33172	1.37	1.37
Maize (Hybrid) <i>fb</i> Wheat	24584	24584	24584	87925	90528	89226	63341	65944	64642	2.63	2.63
Maize (Hybrid) <i>fb</i> Chickpea	24584	24584	24584	89394	92029	90711	64810	67445	66127	2.69	2.69
Maize (Hybrid) <i>fb</i> Mustard	24584	24584	24584	88168	90792	89480	63584	66208	64896	2.64	2.64
Maize (Hybrid) <i>fb</i> Field pea	24584	24584	24584	89054	91594	90324	64480	67010	65740	2.67	2.67
Maize (Hybrid) <i>fb</i> Berseem	24584	24584	24584	88809	91305	90057	64225	66721	65473	2.66	2.66
Maize (Hybrid) <i>fb</i> Lentil	24584	24584	24584	88585	91107	89846	64001	66523	65262	2.65	2.65
SEM±	-	-	-	1354	1170	632	1354	1170	632	-	-
CD (P=0.05)	-	-	-	3970	3430	1803	3970	3430	1803	-	-

tem, and statistically at par with rest of the hybrid maize based cropping systems. Similarly, benefit cost ratio was maximized (2.69) in maize (hybrid) *fb* chickpea treatment followed by maize (hybrid)-field pea (2.67) and maize (hybrid) – berseem (2.66) during two years. The higher net returns and benefit cost ratio were because of comparatively greater increase in gross returns than enhance in cost of cultivation. This could be explained due to the fact that the higher growth, yield attributing parameters as well as superior grain and stover yield of hybrid maize obtained

greater gross monetary returns. The results are confirmed with the findings of Uzoh *et al.* (2019); Kumar *et al.* (2020); Mekasha *et al.* (2021) and Sarwar *et al.* (2021).

CONCLUSION

Thus, it can be concluded that maize (hybrid)-chickpea, maize (hybrid)-fieldpea were found most productive system for higher yield, net returns and B:C ratio of maize based cropping system in Kymore Plateau of Madhya Pradesh.

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