Int.J.Curr.Microbiol.App.Sci (2020) *9*(10): 11-16

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 10 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.910.002

Effects of Different Tillage Practices and Cropping Systems on Crop Productivity

C. K. Arya[1*], Bhim Singh[2] and M. K. Sharma[1]

[1]*College of Horticulture & Forestry (AU, Kota), Jhalawar (Rajasthan), India*
[2]*Department of Basic Sc., SVBP University of Agriculture, Meerut (UP), India*

**Corresponding author*

A B S T R A C T

Keywords

Dryland Agriculture, Tillage operations, Cropping patterns, Soil properties, Crop productivity

Article Info

Accepted:
04 September 2020
Available Online:
10 October 2020

An experiment was conducted to plan research strategies on the basis of identified problems under dryland agriculture through survey and effect of tillage practices on cropping systems in the field at ARSS, Aklera (AU, Kota), Jhalawar. The experiment was laid down with 3 tillage treatments viz. Summer disc harrowing + Cultivator , Deep summer ploughing + harrowing + cultivator, Summer Cultivator + cultivator and 3 important crops Soybean, Black Gram and Maize and examined in a split plot design with four replications. Major soils of the domain area are vertisols with finer texture clay loam, so poor in physical condition. Major research strategies plan was prepared to execute in the study area. The yield under tillage operation of Deep summer ploughing + harrowing + cultivator was found significantly superior followed by treatment of Summer disc harrowing + Cultivator. Significantly higher yield of maize crop was recorded over other crops.

Introduction

Tillage is a mechanically manipulation of soil to make it physically, chemically, and biologically suitable to improve seed germination, seedling emergence and for optimal plant growth. Improved soil conditions due to tillage operation affects plant growth. Mechanized agriculture is an important tool to fulfill the higher food demands due to rapid increase in population in the world. However, the recent increase in the mechanization of agriculture and intensive tillage operations are the main causes of soil compaction. During cultivation, sub-soil compaction is usually caused by tillage system specifically through mechanical practices. Repeated ploughing may result in plough pan formation in cultivated soil due to use of heavy weight tillage machineries (Alam *et al.*, 2013). Annual disturbance and pulverizing caused by conventional tillage produce a finer and loose soil structure as compared to conservation and no-tillage method which leaves the soil intact (Rashidi and Keshavarzpour, 2007). Precise management of irrigation quantity along with the rate and timing of nutrients application are of critical importance to obtain desired results in terms of productivity and nutrient use efficiency (Jat *et al.,* 2011). A good soil management programme protects the soil from water and wind erosion, provides a good, weed-free seedbed for planting, destroys hardpans or compacted layers that may limit root development, and allows maintenance or even an increase of organic matter (Ali *et al.,* 2018). Use of excessive tillage is often harmful to soil. Therefore, currently there is a significance interest and emphasis on the shift to the conservation and no-tillage methods for the purpose of controlling erosion process (Adugna, 2019). Tillage is an effective farm activity to improve soil tilth and soil physical conditions (Khan *et al.,* 2010).

Materials and Methods

Rajasthan is the largest state of India constituting 10.4 per cent of total geographical area and 5.67 per cent of total population of India as per census, 2011. The Agricultural Research Sub Station (ARSS), Aklera (Agriculture University, Kota), Jhalawar is located in the south east part of the Rajasthan with 24.41^o Latitude and 76.56^o Longitude. According to Agro-climatic zones the domain area comes in Humid South Eastern Plain, i.e. zone V of the Rajasthan. The Humid South Eastern plains (zone V) is popularly known as the Hadauti plateau. This region includes the districts of Baran, Bundi, Kota and Jhalawar and part of the Sawaimadhopur district (Khandar, Sawaimadhopur blocks). The region has warm summer but mild winter. Summer temperatures sometimes reach up to 45^oC and in winter it falls to 2.4^oC (Singh, 2016). The relative humidity is generally high in this zone. The annual rainfall varies from 452 to 985 mm. A survey was conducted to explore the natural resource characterization in the domain areas with the following objectives include to characterized the natural resources and delineate the domain area of the centre and identification of the problems under dryland agriculture.

A field experiment was also conducted to study the effect of different tillage practices and cropping systems in dryland conditions. The experiment was laid down with 3 tillage treatments like- Summer disc harrowing + Cultivator, Deep summer ploughing + harrowing + cultivator, Summer Cultivator + cultivator and 3 important crops Soybean, Black Gram and Maize and examined in a split plot design with four replications.

Results and Discussion

The study on land holdings of the domain areas shows that nearly half of the land holdings are below 2 ha. (47%) and 26 per cent is 1-2 ha, only 7 per cent land holdings are > 4 ha. Salient Features of the Agro-climatic Zone V of Rajasthan are presented in table 1.

The details about the land utilization pattern in four district of Rajasthan was collected and concluded in Table 2. Maximum percentage of rainfed area was observed in Jhalawar district.

Soil properties of the domain area was estimated on the basis of Soil samples, collected from the experimental site and analyzed in laboratory of soil science at college and presented in Table 3. Weekly rainfall data measured at the station are depicted in Fig. 1 for irrigation planning in the area.

The outcome of the survey in the form of problems faced by the farmers in dryland farming are as under:

Unavailability of drought resistant varieties in *Kharif* season crops like soybean, sorghum, maize etc.

Mid-season dry spells causing the decrement in productivity.

Major soils of the domain area are Vertisols with finer texture clay loam, hard to fill when wet and extremely dry, so poor in physical condition.

Most of the small and marginal farmers of dryland area have fragmented holding which pose difficulties in adoption of rainwater management and soil conservation techniques.

Due to small holdings the advance agriculture equipments could not be used in the domain areas.

Improper handling and decomposition of organic waste under moisture stress condition despite of lower rate of application.

Farmers face difficulties in adoption of improved farming systems due to lack of technology, fragmented holding, lack of resources for livestock maintenance and socio-economic constraints.

Lack of awareness about suitable alternate land use systems.

Table.1 Salient Features of the Agro-climatic Zone V of Rajasthan

Agro-climatic Zone	**Districts (Blocks)**	**Area (M ha)**		**Rainfall Range (mm)**	**Temp-erature (^oC)**	**Major Crops**		**Soils**
		Total	**Net Sown**			Kharif	Rabi	
Humid South-Eastern Plain	Baran, Bundi, Jhalawar, Kota, Part of Sawai Madhopur (Khandar, Sawai Madhopur)	2.43	1.21	452-985	45 to 2.4	Soybean, Sorghum, Maize	Wheat, chickpea, mustard	Black of alluvial origin, clay loam

Table.2 Land utilization pattern in the study area of Rajasthan (Area in lac ha)

Particulars	**Districts**				
	Kota	**Baran**	**Bundi**	**Jhalawar**	**Zone V**
Total geographical	5.18	6.99	5.83	6.32	24.32
Total cultivated	4.62	5.93	4.61	6.01	21.17
Net sown	2.71	3.42	2.63	3.32	12.08
Gross irrigated	2.58	3.21	2.53	2.83	11.15
Net irrigated	2.44	3.13	2.23	2.69	10.49
Net rainfed	0.27	0.29	0.40	0.63	1.59
% rainfed area to net sown area	9.99	8.48	15.10	19.05	13.16
Gross rainfed	2.04	2.72	2.08	3.18	10.02
% rainfed area to total cultivated area	44.22	45.90	45.04	52.88	41.20

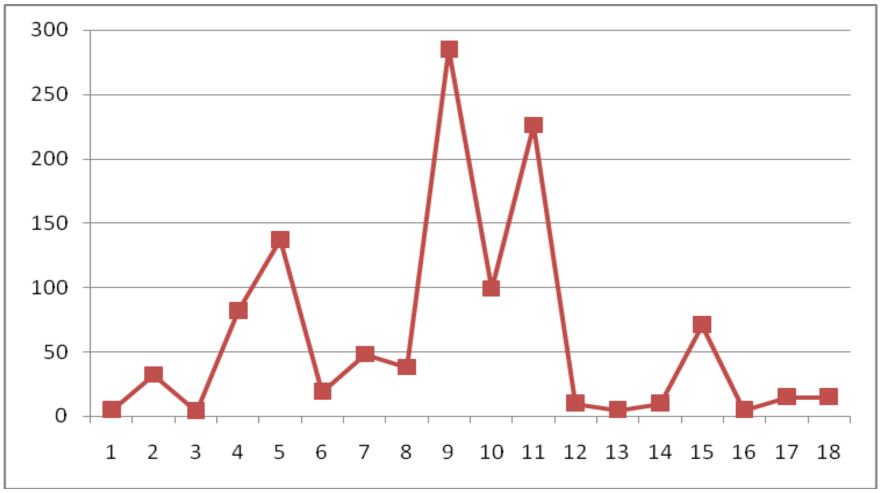
Table.3 Soil properties of the domain area

Field No.	pH	EC dSm^{-1})	OC (%)	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
01	8.10	0.23	0.40	344.8	28	208
02	8.12	0.15	0.29	249.98	37	239
03	8.88	0.79	0.25	215.5	30	243
04	8.86	0.73	0.21	181.02	30	216
05	8.30	0.46	0.23	198.26	29	196
06	7.92	0.35	0.33	284.46	25	289
07	8.84	0.78	0.22	189.64	29	242
08	8.32	0.62	0.12	103.44	20	201
09	8.04	0.28	0.16	137.92	31	267
10	7.09	0.12	0.19	163.78	16	190
11	8.86	0.67	0.17	146.54	29	239
12	8.73	0.60	0.19	163.78	29	247
13	8.83	0.85	0.14	120.68	21	163
14	7.88	0.74	0.22	189.64	31	213
15	8.30	0.46	0.22	189.64	29	196
16	8.78	0.46	0.16	137.92	24	219
17	8.84	0.34	0.32	275.84	28	287
18	8.99	0.55	0.16	137.92	17	156
19	6.47	0.75	0.18	155.16	20	199
20	6.76	0.69	0.24	206.88	25	217

Table.4 Effect of different tillage practices on yield of different cropping systems under dryland conditions

Treatments	Yield (Kg/ha)
A. Tillage Practices (Main Plot)	
T_1 : Summer disc harrowing + Cultivator	1333.0
T_2 : Deep summer ploughing + harrowing + cultivator	1427.2
T_3 : Summer Cultivator + cultivator	1218.7
SEm±	23.0
CD (P=0.05)	79.7
B. Cropping system (SubPlot)	
C_1 :Soybean	1333.2
C_2 :Black Gram	729.3
C_3 :Maize	1916.4
SEm±	27.7
CD (P=0.05)	82.2

Fig.1 Weekly rainfall (mm) from 24th week to 41st Week in the experimental areas



Research strategies

Development and evaluation of drought resistant varieties of soybean, maize and sorghum.

Water harvesting and maximization of water use efficiency.

Fertilizer management practices for reducing the nutrient imbalance in crop production.

Development of intercropping systems.

Development of resource conservation technologies (RCTs).

Development of suitable farming system models for rainfed ecosystem.

Introduction of improved grasses and legumes on pasture lands.

Research on new techniques of soil and water conservation.

Diversification through new fruit plants, vegetables and medicinal plants.

The data pertaining to effect of tillage practices and cropping systems were analyzed statistically and presented in table 4. The results from the experiment reveals that the tillage operation of Deep summer ploughing + harrowing + cultivator was found significantly superior followed by treatment of Summer disc harrowing + Cultivator.

JS-95-60 variety of Soybean, Kaveri of Maize and MukandraUrd of Black gram were grown in the experimental area. Significantly higher seed yield (1427 kg/ha) was recorded under deep summer ploughing + harrowing + cultivator over remaining tillage practices. The maximum yield (1916 kg/ha) was observed under maize crop over different cropping system. g) were observed in deep tillage treatment which was statistically at par with conventional tillage treatment (Anjum *et al.*, 2019). Deep tillage to depth of (30 cm) is an effective approach to breakup compacted subsoil layer (Hou *et al.*, 2012).

In conclusion after comparing various tillage practices, it is cleared that maximum grain yield is recorded with deep tillage practices over other treatments. Therefore, intensive tillage practices could be preferred over minimum and zero tillage practices for higher yield in the study area.

References

Alam, M.K., Salahin, Rashid, M.H. and Salam, M.A. (2013) "Effects of different tillage practices and cropping patterns on Soil Physical Properties and crop productivity" Journal of Tropical Resources and Sustainable Science. Vol.:1(1), pp:51-61

Ali A, Usman M, Adaikwu AO. (2018). "Effect of tillage methods on soil properties, growth and yield of maize (*Zea mays* l.) in Makurdi, Nigeria". International Journal of Science & Healthcare Research. 2018; 3(1): 48-55.

Anjum, S.A., M.M. Raza, S. Ullah, M.M. Yousaf, A. Mujtaba, M. Hussain, M.J. Shah, B. Ahmad and I. Ahmad. 2019. Influence of different tillage practices on yield of autumn planted maize (*Zea mays* L.). Pakistan Journal of Agricultural Research, 32(2): 293-301.

Hou, X., R. Li, Z. Jia, Q. Han, W. Wang and B. Yang. 2012. Effects of rotational tillage practices on soil properties, winter wheat yields and water-use efficiency in semi-arid areas of north-west China. Field Crops Res. 129: 7-13.

Jat, Ram A., Wani, suhas P., Sahrawat, Kanwar, Singh, Piara and Dhaka, B.L. 2011 Fertigation in Vegetable Crops for Higher Productivity and Resource Use Efficiency. *Indian Journal of Fertilizer*, Vol: 7 (3): 22-37.

Khan, N.I., A.U. Malik, F. Umer and M.I. Bodla. 2010. Effect of tillage and farm yard manure on physical properties of soil. Int. Res. J. Plant Sci. 1: 75-82.

Rashidi, M. and F. Keshavarzpour (2007). "Effect of different Tillage Methods on Maize / Int. J. Agri. Biol., Vol. 9(2), pp: 274-277.

Singh, B. 2016 Variability and trend analysis of rainfall data of Jhalawar district of Rajasthan, India. *Journal of Applied and Natural Science*, 8 (1): 116-121.

How to cite this article:

Arya, C. K., Bhim Singh and Sharma, M. K. 2020. Effects of Different Tillage Practices and Cropping Systems on Crop Productivity. *Int.J.Curr.Microbiol.App.Sci.* 9(10): 11-16.
doi: https://doi.org/10.20546/ijcmas.2020.910.002