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Determination of Optimal Balanced Fertilizer Rate and Irrigation Scheduling for Onion Under Vertisol Soil Type

Gebeyehu Tegenu*, Ashebir Haile, Mahelet Wegu, Solomon Gezie and Robel Ademasu
Ethiopian Institute of Agricultural Research
Debre Zeit Agricultural Research Center, P.O.Box 32, Debre Zeit,Ethiopia
*Corresponding author: Email: gebeyehutegenu@gmail.com

Abstract
Onion is one of vegetable crops grown under irrigation. In order to improve crop production and productivity irrigation is the only solution for contributing towards food security, self-sufficiency and export market.. The Experiment was conducted in Debre Zeit Agricultural Research Center with determination of optimal balanced fertilizer rate and irrigation scheduling for Onion under Vertisol soil type to determine the optimum rate of balanced fertilizers and irrigation intervals and identify the interactive effect of nutrient and moisture levels on yield and yield quality of onion.The experimental treatments had three irrigation intervals, viz., 80%MAD, 100%MAD and 120%MAD and three Fertilizer rates of application, viz., 100kgha^{-1}NPSB, 150kgha^{-1}NPSB and 200kgha^{-1}, and a control fertilizer rate of 100kgha^{-1} urea. The design of the experimental plot was split plot in RCBD arrangement. The experimental study result showed that Crop Growth and Physiology Parameters, Yield Parameters and Water productivity had no significance difference under blended fertilizer rate application. But in irrigation intervals plant height, marketable yield and total bulb yield of onion was significantly affected. The highest total bulb yield of onion was recorded on the control irrigation (100% MAD) of the interval.
Keywords: Blended fertilizer, Onion, Manageable Allowable Depletion (MAD), Irrigation Scheduling.
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1. INTRODUCTION

Onion (*Allium cepa L.*) is one of the mostly vital vegetable crops commercially grown in the world (Grubben and Denton, 2004). Onion has economically important role in Ethiopia. The country has massive potential to produce the crop throughout the year both for domestic use and export market. Its production also contributes to commercialization of the rural economy and creates many job opportunity (Nikus and Mulugeta, 2010; Guesh, 2015). Onion is valued for its distinctive pungency and form essential ingredients for flavoring varieties of dishes, sauces, soup, sandwiches, and snacks as onion rings

Plants including onion need various nutrients to sustain their growth and development. Onion requires high level of soil fertility to support high yield. Although the fertilizer requirement depends on type of crops produced, fertility status of the soil, and the environmental conditions of the area .In Ethiopia have been using blanket recommendation of 200 kg DAP (Ammonium sulfate) and 150 kg urea per hectare, which may not satisfy the nutrient requirements of onion plants. Therefore, the Ministry of Agriculture and Natural Resource (MoANR) has recently introduced a new NPS fertilizer, which contains N, P2 O 5 and S with the concentration of 19%, 38%, and 7%, respectively. According to MoANR (2013), DAP is substituted with by NPS fertilizer. Khokhar et al., 2004; Khalid, 2019 reported that Onion requires intensive supply of plant available macronutrient, namely: nitrogen (N), phosphorus (P) and potassium (K) to attain maximum yield of bulbs because the plants have a shallow, sparsely branched root system and NPK fertilizer at rate 100:33:62 significantly influenced onion yield. As Khalid (2019) also revealed application of micronutrient have a significant improvement on onion yield at a rate of zinc sulfate ($ZnSO_4$ at 0.5%), iron sulfate ($FeSO_4$ at 1.0%), and boron (B at 0.5%). Blended fertilizers containing both macro and microelements may possess this characteristic. As the Ethiopian Agricultural Transformation Agency reported that (2016) N: P2O5:S: B(18.9N-37.7P2O5-6.95S-0.1B) fertilizer will substitute DAP all over part of onion growing area of Ethiopia. However, the response of onion to the application rate of the newly introduced blended fertilizer (NPSB) under Debre Zeit area agro-ecological condition was not yet known. Therefore, the objective of the activity was initiated to determine the optimum rate of balanced fertilizers and irrigation intervals for onion crops and to identify the interactive effect of nutrient and moisture levels on yield and yield quality of onion.

2. MATERIAL AND METHODS INTRODUCTION

2.1. Description of the Study Area

The Experiment was conducted in 2016-2018 cropping season at Debre Zeit Agricultural Research Center, main station. The geographical location extent ranges to 08° 44' 15" to 08 ° 46' 45" N Northern latitude and from 38° 59' 45' to 39 ° 01' 00" E Eastern longitude. The research center is located on a nearly level of a very gently sloping topography with a gradient of zero to 2 % slope. . It has low relief difference with altitude ranging from

1610 to 1908 meters above the see level. The site is situated in the Central high land area of the country having Tepid to cool sub-moist highlands type climate. The area receives an annual mean rainfall of 851 mm. The mean maximum and minimum temperature are 28.3 ^{0}C and 8.9 ^{0}C, respectively with the average value of 19 ^{0}C. The experimental fields are dominated by heavy soils (Vertisol)) (WRB, 2014).The source of irrigation water in the study area is ground water.

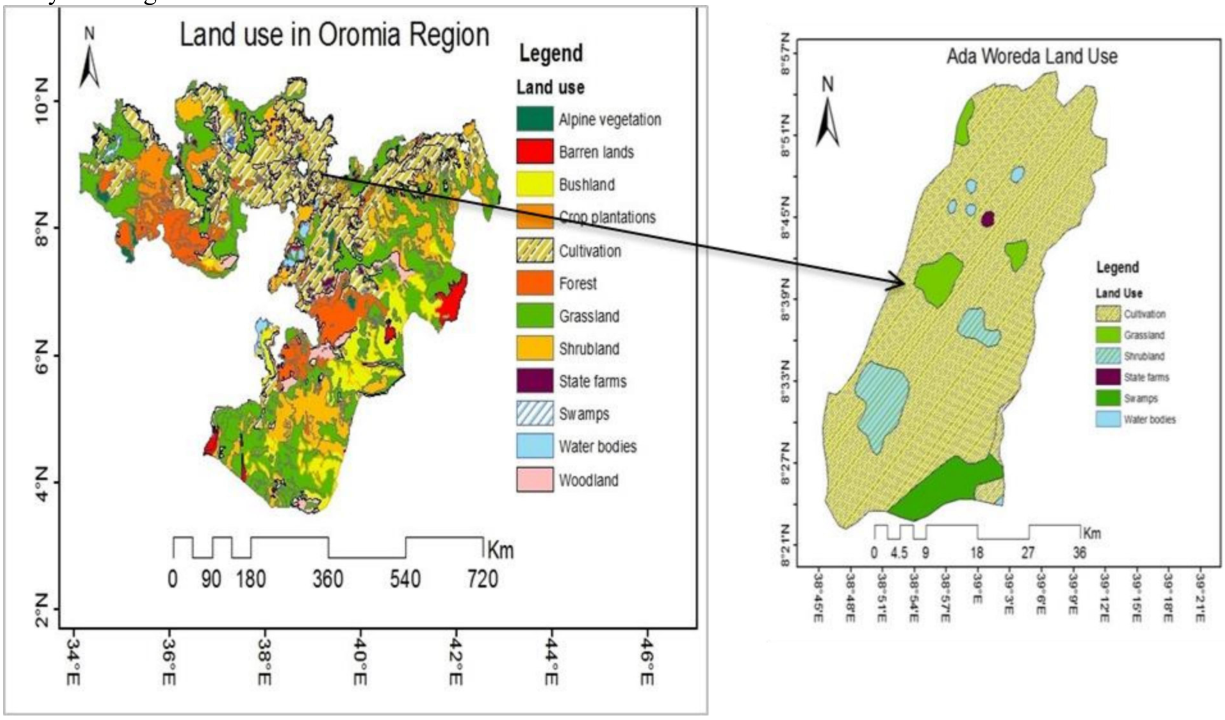

Figure 1 Location map of study area

2.2. Treatments and Experimental Design

The experimental treatments had three irrigation intervals, viz., 80%MAD, 100%MAD and 120%MAD and three Fertilizer rates of application, viz., 100$kgha^{-1}$NPSB, 150$kgha^{-1}$NPSB and 200$kgha^{-1}$, and a control fertilizer rate of 100$kgha^{-1}$ urea. The design of the experimental plot was split plot in RCBD arrangement and replicated three times. The three irrigation intervals were arranged as main plots and the fertilizer rates as sub plots. The experiment had a total of twelve (12) treatment combinations. The experimental field was divided into 36 plots with 3m by 4m plot size to accommodate six furrows with spacing of 60cm having row and plant spacing of 20cm and 10 cm, respectively. The plots and replications had a buffer zone of 2m for canals carrying on irrigation water and 2.5 m for canals carrying irrigation water supply canals between plots to eliminate influence of lateral water movement and also 1.5m between plots. The experimental treatment combination and designation are given in Table 1.

Table 1: Treatment combinations

Treatment	Fertilizer rates (subplot)			
Irrigation Intervals (main plot)	RNP	100 Kg Map Recommended	150 Kg Map Recommended	200 Kg Map Recommended
80% MAD	T1	T2	T3	T4
100% MAD	T5	T6	T7	T8
120% MAD	T9	T10	T11	T12

Remark:-RNP = Recommended nitrogen and phosphorus

- ✓ Map recommended formula means the balanced fertilizer (Formula) identified from the map generated by ATA for the implementing woreda
- ✓ The amount of N available at formula may not be enough for crop, so the remaining will be added by applying additional N from urea.
- ✓ MAD is manageable allowable depletion level of the test crop from FAO/ EIAR recommendation.

2.3. Crop Management Practices

All agronomic Crop management practices are dates of site selection, Land preparation, sowing, seedling preparation, transplanting, treatment application, crop management practice, maturity and harvest. Onion (*Allium cepa* L.) seeds variety Nafis was used as seed material. The selected seed variety was sown on nursery bed. The seedlings were then transplanted on well prepared experimental plots and the seedlings were established in both sides of a ridge with row and plant spacing of 20cm and 10cm, respectively.

The depth of irrigation water to be applied in each treatment was based on allowable soil moisture depletion level and the control plot (100% ETc) should deplete 25% of the total available water in the root zone before the next irrigation. The required depth of irrigation water to be applied in each irrigation application was measured using Parshall flume.

2.4. Crop water requirement and Irrigation water management

The average ETo value of the experimental site was 4.1 mm/day. Using the reference evapotranspiration (ETo) and crop coefficient value, calculation of the total seasonal onion crop water requirement was found to be 414.73mm. The Crop water requirement (ETc) values were low at the beginning of the initial growing season, increased gradually to attain a maximum during development and mid stage and subsequently decreased based on crop growth stages and climate data.

Table 2: The climate data of 42 years (1975-2017) for the study Area

Month	T max (°C)	T min (°C)	Humidity (%)	Wind (m/s)	Sunshine (hrs)	Rad. (MJ/m^2/day)	ETo (mm/day)	Rainfall (mm)	Eff. Rainfal (mm)
January	25.2	8.9	63.0	1.3	9.8	22.0	4.0	9.4	0.0
February	26.3	10.2	46.4	1.4	8.5	21.4	4.4	24.8	4.9
March	27.0	11.3	46.4	1.5	8.1	21.8	4.7	31.5	8.9
April	27.1	11.9	47.7	1.5	7.1	20.4	4.6	44.2	16.5
May	27.7	11.6	46.5	1.6	8.6	22.2	4.9	41.3	14.8
June	26.4	11.4	54.9	1.0	6.3	18.4	3.9	88.9	47.1
July	23.7	12.1	66.4	0.9	4.9	16.4	3.3	235.1	164.1
August	23.9	12.1	67.8	0.9	5.5	17.7	3.5	208.2	142.6
September	24.1	11.5	63.3	0.8	6.7	19.6	3.7	83.6	42.9
October	25.0	9.5	49.9	1.4	8.6	21.7	4.3	25.9	5.5
November	24.6	8.0	47.0	1.3	9.3	21.4	4.1	7.4	0.0
December	24.8	7.4	46.9	1.4	9.4	20.9	4.0	1.0	0.0
Total								**810.3**	**447.3**
Average	**25.5**	**10.5**	**53.9**	**1.2**	**7.7**	**20.3**	**4.1**		

3. RESULTS AND DISCUSSION INTRODUCTION

3.1. Soil Sampling and Analysis

The results of soil analyses and field tests on physical and chemical characteristic are given in Table 3 and 4.

3.1.1. Soil Physical Characteristics

The laboratory analysis indicates that the basis particle size distribution in the soil was average value of 53.60% clay, 22.53% sand and 23.87% silt at experimental site. Therefore based on soil textural class determination triangle of international soil society (ISSS) system (Rowell, 1994) the soil of the experimental site was clay in texture. The bulk density of the experimental site showed slight variation with depth and varied from 1.04 to 1.15g/cm^3. This could be because of slight decrease of organic matter with depth and compaction due to the weight of the overlying soil layer (Brady and Weil, 2002). The weighted bulk density (BD) and Total Available Water (TAW) of the experimental site are given in Table 3.

Table 3: Soil physical properties

Depth (cm)	BD (g/cm3)	FC (%)	PWP (%)	TAW (mm)	Clay (%)	Sand (%)	Silt (%)	Textural class
0-20	1.04	39.35	23.76	32.43	53.6	23.2	23.2	Clay
20-40	1.1	41.94	24.58	38.19	55.6	25.2	19.2	Clay
40-60	1.15	39.9	24.94	34.41	51.6	19.2	29.2	Clay
Average	1.01	40.40	24.43	35.01	52.93	22.53	23.87	Clay

Note: FC: Field Capacity
PWP: Permanent Wilting Point

3.1.2. Soil Chemical Characteristics and Water Properties

Soil PH is an important parameter which measures hydrogen ion concentration in the soil to indicate its acidic and alkaline nature of the soil. According to Murphy (1968) rating scale, the pH value of the current experimental site soils was near to neutral (pH 7.07). Onion can grow well in soil pH range from 6.0 to 8.0 (Olani and Fikre, 2010).The soil had a Cation exchange capacity (12.77meq/100g) through 60 cm profile and average electrical conductivity of (0.280ds/m) which is below the threshold value for onion yield reduction, i.e. 1.2 dS/m (Smith *et al.* , 2011). Organic matter content (OM) improves water-holding capacity, nutrient release and soil structure. The OM content and OC content of the soil had average values of 1.80% and 1.05%, respectively which is rated as low.The findings of Tekalign (1991) who reported that soils having OM value in the range of 0.86-2.59% are considered low.

The laboratory result of the irrigation water showed the pH value of 7.47 and ECw value of 0.67 dS m $^{-1}$ (Table 4). According to Bryan *et al. (*2007), the irrigation water is classified in terms of pH as low (below 7), slight to moderate (7-8) and severe (above 8). Based on this classification, the characteristics of the irrigation water in the study area are found slight to moderate (Table 4).

Bauder *et al*. (2014), who reported that, irrigation water quality salinity hazard, has four categories: (≤ 0.75 dS m $^{-1}$ none), (0.76-1.5 dS m $^{-1}$ some), (1.51-3.00 dS m $^{-1}$ moderate) and (≥3.00 dS m $^{-1}$severe). Based on the above categories the irrigation water quality of the study area was classified at none.

Table 4: Soil chemical and Water properties

Depth(cm)	pH	CEC(meq/100)	EC(ds/m)	OC (%)	OM (%)
0-20	7.10	14.7	0.298	1.15	1.98
20-40	7.11	13.9	0.265	1.12	1.93
40-60	7.00	9.7	0.278	0.87	1.50
Average	7.07	12.77	0.280	1.05	1.80
Irrigation Water					
pH	7.47				
ECw	0.67ds/m				

Note: OC: Organic Carbon

3.2. Crop Growth and Physiology Parameters

3.2.1. Plant height

Analysis of variance has shown no significance difference in plant heights amongst the different fertilizer rate levels. But statically there is a difference as the table shown the highest plant height of (35.81cm) was recorded from 100NPSB balanced fertilizer rate and had no significant differences with other balanced fertilizer rates. The irrigation intervals had a significant ($P<0.05$) effect on onion plant height. The irrigation interval of (120% MAD) application gave the highest plant height and significantly different to all other irrigation interval. The shortest plant height of (32.98cm) was recorded from the irrigation interval of (100%MAD) application but not significantly affect to 80%MAD irrigation interval. The interaction effects of fertilizer rate application and irrigation intervals had no significant effect on Plant height of onion (Table 5). The tallest plant height of (36.10cm) was record from the maximum irrigation interval of (120% MAD) and significantly different to all irrigation intervals. The shortest plant height of (32.98cm) was recorded from irrigation interval of (100%MAD) application and significantly inferior to all irrigation levels.

This result is similar with the finding Mebrahtom *et,al* 2020 reported that onion plant height was not significant difference as blended fertilizer application at Irrigation conditions but There is opposite findings of Morsy *et al*. (2012) and Nasreen *et al*. (2007) who reported that onion plant height significantly increased as the rate of blended fertilizer was increased .

3.2.2. Number of leaf per plant

The result of analysis showed that the number of leaf per plant was no significantly affected both fertilizer rate and irrigation intervals. The interaction effects of fertilizer rate and irrigation intervals had no significant effect on number of leaf per plant (Table 5).The maximum number of leaf per plant was recorded from 200%NPAB fertilizer rate and had no significant difference with others .The irrigation interval of (100% MAD) gave the highest number of leaves per plant and not significantly different to all irrigation intervals. The lowest number of leaves per plant (11.43) was recorded from 80%MAD irrigation application and statically inferior to all irrigation intervals.

3.2.3. Leaf length

The interaction result of fertilizer rate and irrigation intervals had no effect on onion leaf length. The irrigation intervals had no significant effect on onion leaf length.

Among the fertilizer rates, it seems there was no significant difference between all rates. And 100%NPSB fertilizer rate gave statically higher leaf length than all others rate. Among the irrigation intervals, the highest leaf length was recorded from 80%MAD application and statically different to all other irrigation intervals. The irrigation interval of 120% MAD application on the other hand gave the lowest leaf length with value of (18.10 cm).

Table 5: Response of different Fertilizer rates and irrigation intervals on Onion plant height, Leaf number and Leaf length.

Fertilizer Rate	PH(cm)	LN	LL(cm)
100NPSB	35.81	11.84	19.38
100UREA	34.65	11.02	17.59
150NPSB	34.96	12.09	18.78
200 NPSB	34.5	12.42	18.93
LSD(P=0.05)	ns	ns	ns
MAD (%)			
80	33.44b	11.43	19.72
100	32.98b	12.15	18.18
120	36.10a	12.03	18.1
LSD(P=0.05)	3.12	ns	ns
CV (%)	16.67	20.8	23.8

3.3. Yield and Yield Parameters

3.3.1. Onion bulb diameter

The bulb diameter of Onion was measured to grade the size and quality of onion produced. The analysis of variance for bulb diameter has shown no significant difference both among fertilizer rate and also irrigation intervals. The interaction of fertilizer rate and irrigation intervals had no effect on onion bulb diameter (Table 6).The control fertilizer rate (100% urea) gave highest onion bulb diameter of (6.68cm) and had no significant difference with others. The smallest bulb size of (6.56cm) was recorded from 150% NPSB blended fertilizer rate application and no significance difference to all other fertilizer rates.

3.3.2. Onion bulb height

The analysis of variance has shown that there was no significant difference among the different fertilizer rate and irrigation intervals. The interaction effect of fertilizer rates and irrigation intervals has no significance effect on bulb height of onion.

Statically higher bulb height of (5.62cm) was recorded from 100%NPSB fertilizer rate application and had no significant difference with other fertilizer rate application. The shortest bulb height (5.48cm) was recorded from recommended fertilizer rate application and had no significant difference with fertilizer rate applications. Based on irrigation intervals 120% MAD was recorded higher bulb height of onion but no significance effect with others.

Table 6: Different Fertilizer rates and irrigation intervals on Onion bulb diameter and bulb height

Fertilizer Rate	BD(cm)	BH(cm)
100NPSB	6.66	5.62
100UREA	6.68	5.48
150NPSB	6.56	5.57
200 NPSB	6.62	5.51
LSD(P=0.05)	Ns	Ns
MAD (%)		
80	6.34	5.43
100	6.78	5.6
120	6.76	5.62
LSD(P=0.05)	ns	Ns
CV (%)	11.62	10.01

3.3.3. Marketable Bulb Yield

Analysis of variance has shown that marketable bulb yield of onion was not significantly affected by fertilizer rates. Similarly, interaction effect of fertilizer rates and irrigation level has no significantly affected marketable bulb yield of onion. The 200%NPSB fertilizer rate with irrigation intervals scheduled at the control (100%MAD) application gave statically highest marketable bulb yield of (5229 kg ha^{-1}). Among the irrigation intervals the control irrigation interval (100%MAD) practices have shown significant difference on marketable bulb yield which is 38506 kg ha^{-1}. The irrigation interval application of 80%MAD gave significantly the lowest marketable bulb yield of (33581 kg ha^{-1}). Generally, among the fertilizer rate, 100%urea produced the best marketable bulb yield and while significantly lowest mean marketable bulb yield were obtained from 200%NPSB fertilizer rate application.

AS Mebrahtom *et,al* (2020) reported that the application of blended fertilizer rate at irrigation condition there is no onion yield response. Statically the higher fertilizer rates the yield too. But Awoke et,al (2021) Contradictory reported that application of blended fertilizer was increased the yield of hot pepper.

3.3.4. Unmarketable bulb yield

The analysis of variance has shown that unmarketable bulb yield was not significantly affected by interaction effect of fertilizer rates and irrigation intervals. Fertilizer rate and irrigation intervals have also shown not significance difference on unmarketable bulb yield (Table 5).

The fertilizer rate of 100%NPSB gave the lowest unmarketable bulb yield and has no significant difference with other fertilizer rates. The irrigation interval 80%MAD gave the lowest unmarketable bulb yield.

3.3.5. Total bulb yield

The sum of unmarketable and marketable bulb yield of Onion is Total Bulb yield was not significantly affected by interaction effect of fertilizer rate and irrigation interval and whilst irrigation interval was shown significance difference on total bulb yield but fertilizer rate was not significance difference.

The control irrigation interval (100% MAD) gave the maximum total bulb yield of (43155kg ha^{-1}) and had significant difference with 80% MAD and 120%MAD practice. In fertilizer rate significantly highest yield was obtained from 100UREA and lowest total bulb yield was obtained from 100NPSB of fertilizer rate .Significantly lowest total bulb yields were obtained from the 80%MAD practice. Generally as the result showed that in irrigation intervals there is no significance difference between the control and the treatment. In addition the fertilizer rate also similar results. Similarly Mebrahtom *et,al* (2020) also reported that the application of blended fertilizer at irrigated condition was no significance difference but statically significance difference as fertilizer rate increase yield also increase.

3.3.6. Water Productivity

In Crop production system water productivity (WP) is used to define the relationship between crop produced and the amount of water involved in crop production, expressed as crop production per unit volume of water. The analysis of result showed that both fertilizer rate and irrigation interval are no significance difference the same too the interaction result .statically the highest water productivity was recorded the fertilizer rate of 100urea and in irrigation interval 80% MAD was recorded highest water productivity.

Table 7: Responses of different Fertilizer rates and irrigation intervals on Marketable yield, Unmarketable yield, Total bulb Yield, and Water Productivity of Onion

Fertilizer Rate	MAY(kgha-1)	UNY(kgha-1)	TBY(kgha-1)	WP (kg/m^3)
100NPSB	35663	4122	39132	3.37
100UREA	38214	5248	43462	3.39
150NPSB	36878	4489	41327	3.57
200 NPSB	35642	4821	40463	3.32
LSD(P=0.05)	Ns	ns	ns	ns
MAD (%)				
80	33581^{b}	5430.5	38491^{b}	2.9
100	38506^{a}	4649.4	43155^{a}	3.63
120	37712^{ab}	3930.7	41642^{ab}	3.74
LSD(P=0.05)	3229.7	ns	5137.1	ns
CV (%)	21.99	67.94	16.67	35.82

Table 8: The Interaction result of different Fertilizer rates and irrigation intervals on plant height, Number of Leaf, Leaf length, bulb diameter and bulb height of Onion

Treatments	PH(cm)	LN	LL(cm)	BD(cm)	BH(cm)
80% MAD with @ 100NPSB	37.5	12.73	22.2	7.21	5.89
100% MAD with @ 100NPSB	39.83	11.93	23.4	6.59	5.65
120% MAD with @ 100NPSB	43.17	12.4	24.4	7.21	6.47
80% MAD with @ 100UREA	38.83	9.13	26.83	6.63	5.9
100% MAD with @ 100UREA	28.68	12.13	17.8	6.76	5.21
120% MAD with @ 100UREA	39.19	13.2	18.33	6.74	5.99
80% MAD with @ 150NPSB	40.92	9.67	24.07	5.97	5.44
100% MAD with @ 150NPSB	37	13	24.47	6.56	5.68
120% MAD with @ 150NPSB	38.17	13.8	19.47	6.57	5.41
80% MAD with @ 200NPSB	36.21	13.27	20.87	6.11	5.11
100% MAD with @ 200NPSB	40	13.13	21	7.37	6.08
120% MAD with @ 200NPSB	43.67	11.47	24.6	6.43	5.44
80% MAD with @ 100NPSB	29.07	10.67	13.01	6.49	5.33
100% MAD with @ 100NPSB	28.05	11.67	15.85	6.57	5.21
120% MAD with @ 100NPSB	37.27	11.67	17.42	5.87	5.69
80% MAD with @ 100UREA	27.88	11	14.97	6.29	5.16
100% MAD with @ 100UREA	24.41	9.67	13.6	6.45	5.27
120% MAD with @ 100UREA	36.71	11	13.98	7.19	5.37
80% MAD with @ 150NPSB	28.4	12	17.83	6.17	5.6
100% MAD with @ 150NPSB	34.82	14	14.93	6.71	5.92
120% MAD with @ 150NPSB	30.47	10.67	11.9	7.37	5.37
80% MAD with @ 200NPSB	28.71	13	18.02	5.87	4.99
100% MAD with @ 200NPSB	31.07	11.67	14.38	7.23	5.75
120% MAD with @ 200NPSB	27.33	12	14.73	6.7	5.69
LSD 0.05	ns	ns	ns	ns	ns
CV (%)	15.79	21.45	23.62	11.22	9.28

Table 9: The interaction result of different Fertilizer rates and irrigation intervals on Marketable yield, Unmarketable yield, Total bulb Yield, and Water Productivity of Onion

Treatments	MAY(kgha-1)	UNY(kgha-1)	TBY(kgha-1)	WP(m3ha-1)
80% MAD with @ 100NPSB	45407	519	45926	143.99
100% MAD with @ 100NPSB	39333	222	39556	113.38
120% MAD with @ 100NPSB	46222	296	46519	129.04
80% MAD with @ 100UREA	49333	222	49556	156.57
100% MAD with @ 100UREA	46370	74	46444	137.39
120% MAD with @ 100UREA	49481	111	49593	139.38
80% MAD with @ 150NPSB	41704	333	42037	133.46
100% MAD with @ 150NPSB	47704	519	48222	140.93
120% MAD with @ 150NPSB	43481	259	43741	122.65
80% MAD with @ 200NPSB	32111	148	32259	140.67
100% MAD with @ 200NPSB	52296	74	52370	154.91
120% MAD with @ 200NPSB	47778	148	47926	134.62
80% MAD with @ 100NPSB	22613	8424	27117	5.17
100% MAD with @ 100NPSB	30180	9324	39505	7.17
120% MAD with @ 100NPSB	30225	5946	36171	7.89
80% MAD with @ 100UREA	27117	11757	38874	6.2
100% MAD with @ 100UREA	29865	10495	40360	7.09
120% MAD with @ 100UREA	27117	8829	35946	7.08
80% MAD with @ 150NPSB	27703	9790	37252	6.34
100% MAD with @ 150NPSB	33198	7252	40450	7.88
120% MAD with @ 150NPSB	27477	8784	36982	7.17
80% MAD with @ 200NPSB	22658	12252	34910	5.18
100% MAD with @ 200NPSB	29099	9234	38333	6.91
120% MAD with @ 200NPSB	29910	7072	36982	7.81
LSD 0.05	ns	ns	ns	ns
CV (%)	22.44	74.94	18.93	26.91

CONCLUSION

Based on the three year experiment finding application of different rates of blended fertilizer on onion crop in vertisol area under irrigation condition does not significantly affect most of the onion crop parameters such as plant height ,leaf length ,number of leaf ,bulb diameter, bulb height and bulb yield . The maximum total bulb yield of (43155kg ha^{-1}) was recorded at 100% Urea fertilizer application. Therefore, it can be concluded that even though blended fertilizer does not have significant difference among the treatments in all agronomic attributes, but urea fertilizer was recorded best bulb yield of Onion. Under irrigation condition the control irrigation (100%) application was gave highest bulb yield of Onion.

Therefore, based on the results of the study, using blanket recommendation blended fertilizer all over area and soil type may be not correct it can be recommended that further study should be conducted on soil test based application of blended fertilizer and on site specific conditions because the availability of the element may vary depending on the nature of the soil type and climate condition.

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REFERENCE

Awoke Mensa, Wassu Mohammed, Kebede Woldetsadik. Effect of Blended NPS Fertilizer Rates on Dry Fruit Yield and Yield Components of Hot Pepper (*Capsicum annuum* L.) Varieties at Arba Minch, Southern Ethiopia. *Advances in Biochemistry*. Vol. 9, No. 3, 2021, pp. 74-81. doi: 10.11648/j.ab.20210903.16

Bauder, TA.,Waskom, R.M.,Suthernland,P.L and Davis J.K (2014). Irrigation water quality Criteria, Colorado State University: Fact Sheet No. 0.506.www.ext.colostate.edu.

Brady, N.C. and Weil R.R (2002). The nature and Properties of Soils. 13th ed. Person Education Ltd., USA.

Bryan, G.,Donald, A., and Robert, G (2007). Managing irrigation water quality for crop production, Washington state university.

EthioSIS. Soil fertility and fertilizer recommendation atlas of Tigray region. Ministry of Agriculture (MoA) and Agricultural
Transformation Agency (ATA). 2016

Grubben JH, Denton DA (2004). Plant resources of tropical Africa. PROTA Foundation, Wageningen; Back huys, Leiden; CTA, Wageningen.
Guesh T (2015). Growth, yield, and quality of onion (*allium cepa* l.) as influenced by intra-row spacing and nitrogen fertilizer levels in central zone of Tigray, Northern Ethiopia. M.Sc. Thesis. Haramaya university, Haramaya
Tekalign Tadese(1991).Soil, plant, water, fertilizer, animal manure and compost analysis. Working document No.13. International Livestock Research Center for Africa, Addis Ababa, Ethiopia.

Khalid MK (2019). Mineral nutrient management for onion bulb crops – a review. The Journal of Horticultural Science and Biotechnology pp. 2380-4084.

Khokhar KM, Khokhar MA, Tariq M, Hussain SI, Hidayatullah U, Laghari MH (2004). Comparative economics, monetary and yield advantages from NPK fertilization to onion. Pakistan Journal of Agricultural Research 18:46-50

Ministry of Agriculture and Natural Resource. (2013). Ethiopia is transitioning into the implementation of soil test based fertilizer use system. www.moa.gov.et/documents/93087/.../ be8d5386-e5fb-4ca3-8ff0-d295bc603e70.

Morsy MG, Marey RA, Karam SS, Abo-Dahab AMA (2012). Productivity and storability of onion as influenced by the different levels of NPK fertilization. Agricultural Research Kafer El Sheikh University 38(1):171-187.

Murphy H.F (1968).Report on fertility states and other data on some soils of Ethiopia collage of Agriculture HSIU. Experimental Station Bulletin No.44 Collage of Agriculture: 551p.

Nasreen S, Haque MM, Hossain MA, Farid ATM (2007). Nutrient uptake and yield of onion as influenced by nitrogen and sulphur fertilization. Bangladesh Journal of Agricultural Research 32(3):413-420.

Nikus O, Mulugeta F (2010). Onion seed production techniques. A manual for extension agents and seed producers, Asella, Ethiopia P1.

Olani Nikus and Fikre Mulugeta (2010). Onion seed production techniques. A Manual for Extension Agents and Seed Producers. Asella, Ethiopia.

Rowell D.L (1994).Soil science: Method and applications. Longman Scientific and Technical, Longman Group UK Limited Addison, Wesley, England.350p.

Solomon Mebrahtom, Kinfe Tekulu, Tewolde Berhe, Tsadik Tadele, Weldegebreal Gebrehiwot, Gebresemaeti Kahsu, Samrawit Mebrahtu and Goitom Aregawi(2020) . Evaluation of blended fertilizer on growth performance and yield of onion (*Allium cepa* L.) at irrigated conditions Tselemti District North Western Tigray, Ethiopia African Journal of Agricultural Research Vol. 16(9), pp. 1239-1244, September, 2020 DOI: 10.5897/AJAR2020.14953 ISSN: 1991-637X