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(N.P.K) fertilizer application levels in Onion Crops and Using the Diagnosis and Recommendation Integrated System – DRIS

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Abstract

Fertilizations is one the efforts done to increase the production and quality of crops. Nitrogen, phosphorus and potassium fertilizers rate used in the production of Onion are excessive, so the essential elements present in the soil can be imbalanced ,nutrient balance determines crop yield and quality. This research aimed to evaluate Onion productivity subjected to various ratios of(NPK) to establish the DRIS-Norms and indexes, by using leaf nutrient analysis. The Diagnosis and Recommendation Integrated System-DRIS depended on interrelation between elements, compares crop mineral nutrient proportions with DRIS-norms (Optimal values) and we can know imbalances, deficiencies and excesses in nutrient of plants .The research was conducted in the experimental farm of college of agriculture ,university of Salahaddin in Grdarash field Erbil-Iraq,3.5Km to the south of Erbil city, (36° ON, 44° 01 E), (0411359, 03997002 UTM) ,planting date 30/1/2020 and harvesting at 30/6/2020 so the research period 5 months. We used spilt – spilt design in the experiment, first factor was Nitrogen (0, 40, 80, 160 Kg.ha^{-1}), second factor was Phosphorus (0, 80, 160 Kg.ha^{-1}) and the third factor was Potassium (0, 50, 100 Kg .ha^{-1}) .The results indicated that the best fertilizer combinations that recorded highest Onion-Yield (18.36 Mg. ha^{-1}) was(K 50 Kg. ha^{-1}, P 160 Kg. ha^{-1}, N 40 Kg. ha^{-1}) which had lowest Nutrient Balance Index-(NBI), its values was (9.04) but the highest value was (73.18) for (K0P0N0) treatment**.**

Keywords : Dris, Leaf Analysis, Nutrient Balance, Onion (*Allium Cepa*).

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Introduction

Onion (*Allium cepa*) is a member of the *Alliaceae* family and is one of the most important, economic vegetables, widely used worldwide and has several uses as food, medical using and source of income and employment opportunities that encourage the economic development of the countries [1], and [2].[3] pointed that the NPK- fertilizer combination (125,100,100, Kg. ha^{-1}) recorded highest significant Onion-yield .Fertilizing is one of the efforts have been done to increase the production and quality of yield of onion bulbs by increasing the availability of nutrients. The balanced NPK application is very necessary for younger Onion plants because those macronutrients can stimulate plants vegetative growth ,storage tissue maybe effected by Nitrogen supply [4], [5]. Application of Sulfur(not a factor of the research) to all the treatments without distinction to increases the availability of nutrients in our calcareous soil because it mending soil physical and chemical properties, it decreases the soil PH so the plants can absorb the essential Macro and Micro nutrients from the soil [6],[7], in addition of that Sulfur regarded an essential nutrient[8].Nutrient imbalance in the soil reduces the uptake of some nutrients, which affects the health of the plants making them more sensitive to stress conditions remarked on the relevance of nutritional management to prevent and control plant diseases. Appropriate nutritional management contributes to successful cropping, production, cost reduction, and more sustainable agriculture[9], [10]. Among the available mechanisms for optimizing fertilization recommendations, techniques that identify nutrient uptake during the entire plant lifecycle, such as leaf nutrient analysis, are essential and can be used to compare the results in different cropping areas that provide conditions to improve fertilization management. The results of the leaf nutrient analysis can be interpreted using several methods that can determine the adequate ranges of nutrients or critical levels in plant tissues for different parts of the plants separately and without the need, for calibration tests [11] ,[12].There is some disagreement among researches concerning the nutritional status necessary for good Onion- yields .Some researchers have proposed critical values or sufficiency ranges for the major nutrients [13]. The diagnosis and recommendation integrated system (DRIS) is a nutritional -diagnosis method it goes much further than single nutrient ratio approach in that it employs a minimum of three nutrient ratios per diagnosis, and often as many as six or seven and automatically ranks nutrient deficiencies or excesses in order of importance, so DRIS is a tool for a nutritional -diagnosis that is capable of validation in Agricultural – System worldwide[14], [15] .The diagnosis calculated by the DRIS, which is considered a reference, is based on the correlation between the nutrients taken up by high-productivity plants. The appropriate correlations are referred to as standard and identify those nutrients taken up in low quantity, appropriate levels, or even in excessive amounts. The DRIS index values suggest which nutrient is the most limiting, and also can provide the limiting sequence of all the nutrients, so DRIS is a system of calculations by which ratios of tissue nutrient concentration in a sample are compared to the optimum values of the same ratios in a high – yielding. This system gives an index for each nutrient, which is a mean of the deviations of the ratios containing a given nutrient from their DRIS norms values. Positive and negative indices refer to nutrition excess or deficiency, respectively, and a (DRIS index) of zero or close to zero indicates nutritional balance increased production, avoid the waste of mineral resources and money, and consequently are more[16], [17]. The advantages of DRIS were reported in studies with many crops, vegetables and fruits. The uptake of nutrients and their use are complex processes, in which nutrients interact through chemical reactions during plant lifecycles. The stoichiometry of nutrients has been studied to provide relevant information regarding nutrient uptake and distribution in plants. Therefore, tools such as DRIS can help understand the relationship between nutrients and soil science and must be considered stated that DRIS is an efficient and cheap option for establishing nutrient patterns, even for small plantations and properties. For future crops, the provided data will guide better nutritional management and an increase in production [18], [19].

Material and method

The study was carried out at Grdarasha field the experimental farm of the college of Agriculture university of Salahaddin, 3.5 Km to the south of Erbil city, it is 411 m above the mean sea level, (36° ON, 44° 01 E), (0411359, 03997002 UTM), during the growth season 2020.

Experiment design

This study used a split-split design with three factors : Nitrogen (0, 40, 80, 160) Kg. ha^{-1} which equivalent to (0, 10.434, 20. 869, 41.738) gm/furrow. Phosphorus (0, 80 ,160) Kg. ha^{-1} which equivalent to (0, 22.857, 45.714) gm Triple supper Phosphate fertilizer per furrow. potassium (0, 50 ,100) Kg. ha^{-1} which equivalent to (0, 10, 20) gm KCL per furrow .These treatments were replicated 3 times, so we have 108 experimental unit (4N * 3P * 3 K = 36 treatment * 3 replication).

Preparation of soil and planting

After finishing tillage processes and softening the surface of the soil under study the furrows prepared with the size (60 cm * 200 cm) .The distance between the experimental units were 100 cm and between the blooks 100 cm. Local hot red species of onion blubs were planted at 30/1/2020 in the planting holes and planting were done on the both side of the furrows, the distance between the plants was 15 cm .

Fertilization and Irrigation

Nitrogen (0,40, 80, 160 Kg. ha^{-1}) which equivalent to (0, 10.434, 20. 869, 41.738 gm/furrow)Urea. Phosphorus(0, 80 ,160 Kg. ha^{-1}) which equivalent to (0, 22.857, 45.714gm) Triple supper Phosphate fertilizer per furrow. potassium (0, 50 ,100 Kg. ha^{-1}) which equivalent to (0 ,10, 20 gm KCL)per furrow .The NPK fertilizers was added as two dosage 50% of the amount after three weeks from planting and the other 50% after a month of the first addition. Sulphur: We applied Agricultural Sulphur which content about 99% pure Sulphur, the amount was (6 Mg. ha^{-1}) for all treatments which equivalent to (720 gm) Agricultural Sulphur per furrow constantly without distinction before planting .water was applied to the treatments when plants needed and the source was the water of Grdarasha well [(PH= 7.72), (EC= 0.36 des .m^{-1}), ($Ca^{=2}$ =0.81, $Mg^{=2}$ = 0.34, $Na^{=2}$= 0.17, $K^{=1}$ = 0.003, Cl^{-1} =0.31, $HCo_3{}^{-1}$ = 0.94 and $So_4{}^{-2}$ =0.07) Cmolc. L^{-1})], observation were made on growth and yield of the bulbs and we don't observe any diseases on the plants.

Harvesting

After planting the local hot red species of onion-bulbs at 30/1/2020, harvesting done at 30/6/2020 after 5 months from planting where the leaves are thinning and tallow and yield bulbs are firm, onions were ready to be harvested. Harvesting is done by removing the entire plants carefully in order to avoid the bulbs to be left behind and they were cleaned.

Plant analysis

(N.P.K.S.) – Determination, Available sulfate – Precipitation --Method described by [20], Available Nitrogen -- Kjeldahil -- Method described by [21], Available Phosphorus --- Spectrophotometer described by [22] and Available Potassium ---- Flame photometer described by [21] .

Table (1) shows some the soil chemical and physical properties under the study .

Properties	Value	Unit
EC e	0.51	$ds.m^{-1}$
PH	7.9	
Organic matter	8.5	$g.Kg^{-1}$
Total $caco_3$	250	$g.Kg^{-1}$
Active $caco_3$	15	$g.Kg^{-1}$
CEC	27	$Cmolc .Kg^{-1}$
Magnesium(dissolved)	1.3	$Cmolc .Kg^{-1}$
Calcium (dissolved)	2.7	$Cmolc .Kg^{-1}$
Sodium (dissolved)	0.3	$Cmolc .Kg^{-1}$
Bicarbonate (dissolved)	1.4	$Cmolc .Kg^{-1}$
Chloride (dissolved	2.5	$Cmolc .Kg^{-1}$
Available Sulfate	18.5	$Cmolc .Kg^{-1}$
Available Nitrogen	61	$mg.Kg^{-1}$
Available Phosphorus	4.5	$mg.Kg^{-}$
Available Potassium	56	$mg.Kg^{-}$
Sand	133	$g.Kg^{-1}$
Silt	496	$g.Kg^{-1}$
Clay	371	$g.Kg^{-1}$
Texture name	Silty clay loam	
Specific surface area	90	$M^2. g^{-1}$

D.R.I.S. ---Mythology

Norm determination

DRIS – Norms established from Highest – Yield of the experiment units this method called (Target Method), the Norms are the means of the different leaf nutrient concentration of the High – Yielding, from the data- base observations selected together with their Respective coefficient of Variation[23].

In our research up to (70 % of Relative Yield)10 treatments considered High – Yielding population with three replications.

Calculation D.R.I.S. Indexes (indices)

D.R.I.S.-indexes were calculated for nutrients using the generalized formula depending on
[14].

Index A = [f (A/B) + f (A/c) + f (A/D) ……….. + f (A/N)] / Z .

Index B = [- f (A/B) + f (B/C) + f (B/D) ……….. + f (B/N)/ Z .

Index N = [- f (A/N) – f (B/N) – f (C/N)…….. – f (M/N)/ Z .

If A/B ≥ a/b, f (A/B) = (A/B / a/b - 1) * 1000 / CV

If A/B ≤ a/b, f (A/B) = (1 - a/b/ A/B) * 1000 / CV

Where :

A/B is the tissue nutrient ratio of the plant to be diagnosed .

a/b is the Optimum value (norm) for that given ratio.

Z = the number of functions in the nutrient index .

$$cv\ \% = \frac{SD}{\bar{x}} \times 100$$

Where:

CV is the coefficient of variation associated with the norm.

$\bar{x}$ = Mean of the concentration for certain nutrients .

SD = standard deviation of nutrients of the nutrients (square root of variance).

f (A/C), f (A/D) and other functions Values were calculated in the same way using appropriate norms and CV .The

Microsoft Excel -- program we applied for descriptive statistics for yield, leaf nutrient concentration and Nutrient – Ratio .

Results Discussion

A higher yield is correlated with an adequate crop nutritional status through leaf analysis by establishment DRIS– Norms [24]. Diagnosis and Recommendation Integrated System-DRIS based on :-

1-Nutrient ratios are frequently better indictors of elements deficiencies than Isolated concentration values.
2-Some elements ratios are significant or serious than others.
3- Reaching maximum yield are only when important ratio of nutrient are near optimum (ideal) values, which are taken from high yielding selected populations.
4-The variance of an important– elements ratio is smaller in high – yielding (population)than in a low .
5 -DRIS – indexes can be determined for each nutrition by using the average elements (nutrient) ratio deviation obtained from the comparison with the optimum value of given nutrient – ratio, hence, as pointed by[25] and [26]the ideal DRIS - index value for each nutrient should be zero.

DRIS- approach calculates nutrient balance index (NBI) or It called absolute total (A.T), which indicates the overall nutrient balance in the plant. It provides a mean of excesses and deficiencies. Over other diagnosis method DRIS has some advantages; easy interpretation; allows nutrient classification (from most deficient up to the most excessive) and it allows to diagnose the total nutritional balance, through an un balance index[27]. (DRS) was the best system from other systems(CNR, CNL ,SL and CND) that used for diagnosis Nutrient–requirements[28] .

Table (2) Shows the concentration of nutrients in Onion leaf ,Yield and Relative Yield. DRIS– Applying is by evaluation the standard values(norms). In our research we calculate the DRIS– Norms from the Nutrient- concentration ratios of the treatments that it is Relative - yield above 70%. High yield population are the treatments(with R.Y. % above 70%). Low yield population (with R.Y.% under 70%) .

Table (2) NPKS percentages in Onion leaves ,yield Mg. ha^{-1} and Relative Yield %

Treatment	N%	P%	K%	S%	Yield	R.Y %
K0P0N0	3.02	0.07	1.96	1.53	10.35	56
K0P0N1	2.89	0.1	1.98	1.29	10.48	57
K0P0N2	3.19	0.13	1.95	1.4	10.43	57
K0P0N3	2.16	0.07	1.77	1.37	10.53	57
K0P1N0	2.27	0.12	1.98	1.33	10.49	57
K0P1N1	3.09	0.13	1.94	1.22	10.64	58
K0P1N2	3.09	0.08	1.96	1.56	12.39	67
K0P1N3	3.14	0.1	1.94	1.22	10.77	59
K0P2N0	2.16	0.11	1.9	1.28	10.70	58
K0P2N1	3.11	0.07	1.94	1.28	10.88	59
K0P2N2	2.73	0.09	1.97	1.21	13.99	76
K0P2N3	2.93	0.11	1.94	1.16	16.10	88
K1P0N0	2.33	0.08	2.24	1.52	10.59	58
K1P0N1	2.5	0.1	2.16	1.43	10.77	59
K1P0N2	2.64	0.14	2.14	1.48	10.88	59
K1P0N3	2.71	0.08	2.27	1.45	10.61	58
K1P1N0	2.24	0.12	2.5	1.38	15.48	84
K1P1N1	2.36	0.14	2.24	1.56	17.07	93
K1P1N2	2.74	0.1	2.12	1.3	17.72	97
K1P1N3	2.8	0.1	2.47	1.43	13.17	72
K1P2N0	2.12	0.14	2.34	1.51	14.43	79
K1P2N1	2.6	0.11	2.28	1.46	18.36	100
K1P2N2	2.65	0.09	2.27	1.33	13.10	71
K1P2N3	2.95	0.12	2.24	1.36	12.94	70
K2P0N0	2.13	0.08	2.19	1.25	10.36	56
K2P0N1	2.48	0.11	2.2	1.45	10.67	58
K2P0N2	2.57	0.14	2.11	1.2	10.63	58
K2P0N3	2.84	0.07	2.06	1.47	10.88	59
K2P1N0	2.23	0.1	2.19	1.23	11.04	60
K2P1N1	2.55	0.13	2.22	1.34	11.69	64
K2P1N2	2.61	0.07	2.27	1.59	11.38	62
K2P1N3	3.05	0.1	2.41	1.4	10.92	59
K2P2N0	2.16	0.14	2.16	1.25	10.63	58
K2P2N1	2.63	0.07	2.28	1.28	12.44	68
K2P2N2	2.65	0.07	2.28	1.39	11.17	61
K2P2N3	3.18	0.14	2.24	1.34	11.79	64

The DRIS - Norms were taken locally from High – Yielding Crops treatments depending on the three - replications (NPKS) Concentrations and there ratios in Onion leaf table (3) .

Table (3) NPKS percentages with their ratio in Onion leaf

Treatment	N %	P %	K %	S %	N/P	N/K	N/S	p/K	P/S	K/S
K0P0N0	3.02	0.07	1.96	1.53	43.14	1.54	1.97	0.04	0.05	1.28
K0P0N1	2.89	0.1	1.98	1.29	28.90	1.46	2.24	0.05	0.08	1.53
K0P0N2	3.19	0.13	1.95	1.4	24.54	1.64	2.28	0.07	0.09	1.39
K0P0N3	2.16	0.07	1.77	1.37	30.86	1.22	1.58	0.04	0.05	1.29
K0P1N0	2.27	0.12	1.98	1.33	18.92	1.15	1.71	0.06	0.09	1.49
K0P1N1	3.09	0.13	1.94	1.22	23.77	1.59	2.53	0.07	0.11	1.59
K0P1N2	3.09	0.08	1.96	1.56	38.63	1.58	1.98	0.04	0.05	1.26
K0P1N3	3.14	0.1	1.94	1.22	31.40	1.62	2.57	0.05	0.08	1.59
K0P2N0	2.16	0.11	1.9	1.28	19.64	1.14	1.69	0.06	0.09	1.48
K0P2N1	3.11	0.07	1.94	1.28	44.43	1.60	2.43	0.04	0.05	1.52
K0P2N2	2.73	0.09	1.97	1.21	30.33	1.39	2.26	0.05	0.07	1.63
K0P2N3	2.93	0.11	1.94	1.16	26.64	1.51	2.53	0.06	0.09	1.67
K1P0N0	2.33	0.08	2.24	1.52	29.13	1.04	1.53	0.04	0.05	1.47
K1P0N1	2.5	0.1	2.16	1.43	25.00	1.16	1.75	0.05	0.07	1.51
K1P0N2	2.64	0.14	2.14	1.48	18.86	1.23	1.78	0.07	0.09	1.45
K1P0N3	2.71	0.08	2.27	1.45	33.88	1.19	1.87	0.04	0.06	1.57
K1P1N0	2.24	0.12	2.5	1.38	18.67	0.90	1.62	0.05	0.09	1.81
K1P1N1	2.36	0.14	2.24	1.56	16.86	1.05	1.51	0.06	0.09	1.44
K1P1N2	2.74	0.1	2.12	1.3	27.40	1.29	2.11	0.05	0.08	1.63
K1P1N3	2.8	0.1	2.47	1.43	28.00	1.13	1.96	0.04	0.07	1.73
K1P2N0	2.12	0.14	2.34	1.51	15.14	0.91	1.40	0.06	0.09	1.55
K1P2N1	2.6	0.11	2.28	1.46	23.64	1.14	1.78	0.05	0.08	1.56
K1P2N2	2.65	0.09	2.27	1.33	29.44	1.17	1.99	0.04	0.07	1.71
K1P2N3	2.95	0.12	2.24	1.36	24.58	1.32	2.17	0.05	0.09	1.65
K2P0N0	2.13	0.08	2.19	1.25	26.63	0.97	1.70	0.04	0.06	1.75
K2P0N1	2.48	0.11	2.2	1.45	22.55	1.13	1.71	0.05	0.08	1.52
K2P0N2	2.57	0.14	2.11	1.2	18.36	1.22	2.14	0.07	0.12	1.76
K2P0N3	2.84	0.07	2.06	1.47	40.57	1.38	1.93	0.03	0.05	1.40
K2P1N0	2.23	0.1	2.19	1.23	22.30	1.02	1.81	0.05	0.08	1.78
K2P1N1	2.55	0.13	2.22	1.34	19.62	1.15	1.90	0.06	0.10	1.66
K2P1N2	2.61	0.07	2.27	1.59	37.29	1.15	1.64	0.03	0.04	1.43
K2P1N3	3.05	0.1	2.41	1.4	30.50	1.27	2.18	0.04	0.07	1.72
K2P2N0	2.16	0.14	2.16	1.25	15.43	1.00	1.73	0.06	0.11	1.73
K2P2N1	2.63	0.07	2.28	1.28	37.57	1.15	2.05	0.03	0.05	1.78
K2P2N2	2.65	0.07	2.28	1.39	37.86	1.16	1.91	0.03	0.05	1.64
K2P2N3	3.18	0.14	2.24	1.34	22.71	1.42	2.37	0.06	0.10	1.67

Table (4) describes the possibility of Norms, Standard Deviation(S D)and Coefficient of Variance (CV %), so we can selecting the best Norms depending on Lower (CV%).

Table (4) average of selected Norms, Standard Deviation and percentage of Coefficient of Variance for NPKS

	N/P	N/K	N/S	p/K	P/S	K/S
Average	24.49	1.18	1.93	0.05	0.08	1.64
Standard Division	7.05	0.2	0.34	0.01	0.02	0.13
Coefficient of variance %	28.79	16.95	17.62	20	25	7.93

From the High-Yield treatment (K1P2N1) we calculated the Norms, Standard Deviation (SD) and Coefficient of Variance (CV%) for the Nutrient under study. Nutrient-- Indexes (indices) calculated by applying [29] formula after definition the norms, Nutrient-- Indexes ranges from negative to positive values. In the same treatment all the Indexes are balanced around Zero [14]. Consequently the sum of the nutritional-- Indexes must be zero .If the results are Negative (lower than zero), that shows deficiency. On the other hand, High - Index values (the more positive and distant from zero indexes) indicates the Excessive amount of the element [14], for example the treatments (K1P1N2), sum of Nutrient – Indexes equal to zero (4.99) + (-2.91) + (-1.11) + (-0.97)= zero table (5).

The positive Index mean that the nutrient level are above the Optimum but the negative Index indicate that the levels of nutrient are below the Optimum.

Table (5) DRIS index ,absolute total (NBI) ,Onion yield and relative yield .

Treatment	N INDEX	P INDEX	K INDEX	S INDEX	AT	Yield	R.Y %
K0P0N0	15.26	-25.47	-11.12	21.33	73.18	10.35	56
K0P0N1	9.79	-2.34	-7.71	0.26	20.10	10.48	57
K0P0N2	11.04	7.68	-20.61	1.90	41.22	10.43	57
K0P0N3	-0.56	-14.96	-7.59	23.11	46.21	10.53	57
K0P1N0	-6.46	8.65	-7.23	5.04	27.38	10.49	57
K0P1N1	12.44	10.45	-13.87	-9.02	45.77	10.64	58
K0P1N2	13.79	-17.90	-15.69	19.80	67.18	12.39	67
K0P1N3	16.89	-2.42	-9.14	-5.32	33.77	10.77	59
K0P2N0	-6.33	6.48	-6.29	6.14	25.24	10.70	58
K0P2N1	21.38	-22.03	-4.07	4.72	52.20	10.88	59
K0P2N2	9.39	-5.34	-2.16	-1.88	18.78	13.99	76
K0P2N3	12.36	3.69	-6.91	-9.14	32.10	16.10	88
K1P0N0	-5.35	-15.79	4.57	16.58	42.29	10.59	58
K1P0N1	-2.11	-3.49	-1.89	7.49	14.98	10.77	59
K1P0N2	-4.12	11.03	-11.68	4.76	31.58	10.88	59
K1P0N3	4.05	-17.42	4.75	8.62	34.83	10.61	58
K1P1N0	-13.42	4.08	11.33	-1.98	30.81	15.48	84
K1P1N1	-12.82	11.03	-7.78	9.57	41.20	17.07	93
K1P1N2	4.99	-2.91	-1.11	-0.97	9.98	17.72	97
K1P1N3	1.13	-7.50	6.96	-0.59	16.18	13.17	72
K1P2N0	-20.18	12.54	0.22	7.42	40.37	14.43	79
K1P2N1	-2.69	-1.01	-0.82	4.52	9.04	18.36	100
K1P2N2	2.74	-9.12	6.28	0.11	18.25	13.10	71
K1P2N3	4.67	2.52	-3.29	-3.90	14.38	12.94	70
K2P0N0	-5.69	-10.49	13.21	2.97	32.36	10.36	56
K2P0N1	-4.35	0.27	-2.48	6.56	13.66	10.67	58
K2P0N2	-1.16	15.43	-3.05	-11.22	30.86	10.63	58
K2P0N3	10.93	-24.53	-2.61	16.21	54.28	10.88	59
K2P1N0	-5.48	-0.23	8.31	-2.60	16.62	11.04	60
K2P1N1	-3.68	8.57	-1.89	-3.00	17.13	11.69	64
K2P1N2	2.21	-27.30	4.62	20.47	54.60	11.38	62
K2P1N3	6.70	-7.86	4.08	-2.92	21.56	10.92	59
K2P2N0	-12.55	17.07	0.86	-5.38	35.86	10.63	58
K2P2N1	6.96	-22.83	14.55	1.33	45.66	12.44	68
K2P2N2	5.79	-24.64	10.78	8.07	49.29	11.17	61
K2P2N3	7.43	9.15	-7.35	-9.23	33.17	11.79	64

[27]pointed that the Optimum level occur when the DRIS – Indexes is equal to zero. In table (5) the highest absolute total was (73.18) in the treatment (K0P0N0), after addition Nitrogen ,Phosphorus and potassium to the soil the nutrient imbalance reduced so the Nutrient Balance index - (AT) decreased like (K1P1N2) the absolute total was recorded is (9.98) also the DRIS – Indexes are (4.99)nitrogen, (-2.91) phosphorus, (-1.11) Potassium and (-0.97) sulfur also the Onion yield was (17.72 $Mg.ha^{-1}$) the relative yield was (97%). The highest Onion yield was for the (K1P2N1) treatment combination (18.36 Mg $.ha^{-1}$) which it is relative yield equal to (100%) so this treatment was the most balance treatment among the studied experiment units with DRIS – Indexes(-2.69, -1.01 ,- 0.82 and 4.52) for (N.P.K.S)respectively and absolute total (9.04) .When the Onion content were excessive (positive index), adequate (zero index) or deficient (negative) .This result is to be coupled with higher yield with the smaller absolute total- AT for nutrient Index elements value agree with [30] on Soybean and [31]on Corn. These discussion supported by the information's in the figure (1) there are Negative significant correlation between NBI - (Nutrient Balance Index) and RY % - (Relative Yield Percentage) and confirmed by [32]on Wheat so we can obtained that highest NBI(73.18) recorded for(K0P0N0) with lowest RY%(56) and lowest NBI(9.04) recorded for(K1P2N1) with highest RY%(100) .

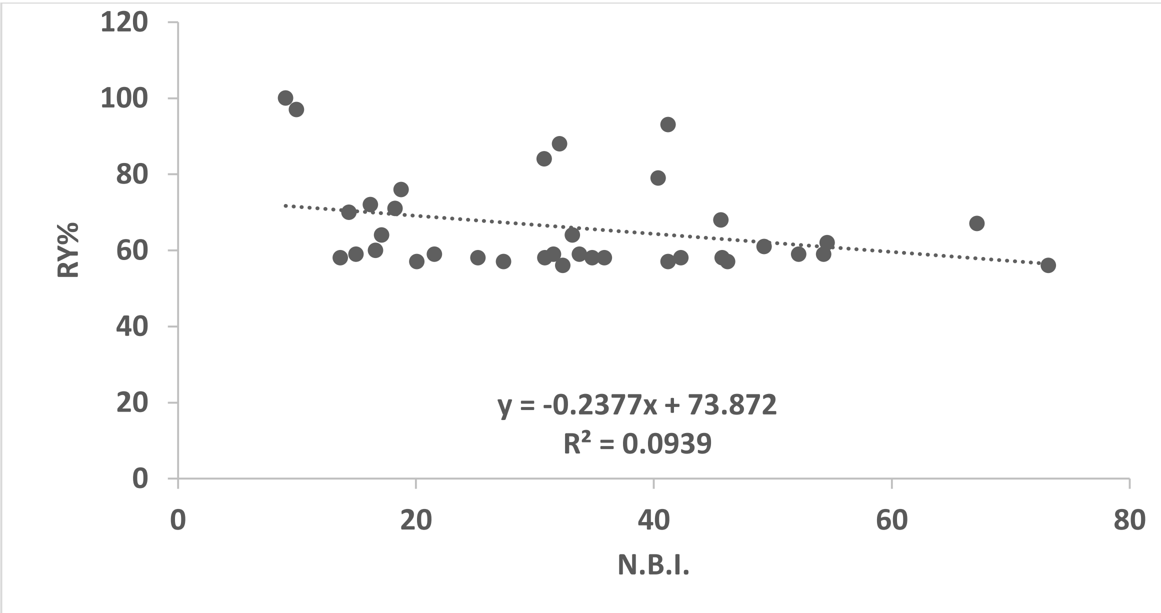

Figure (1) The relationship between Nutrient Index and percentage of elative yield .

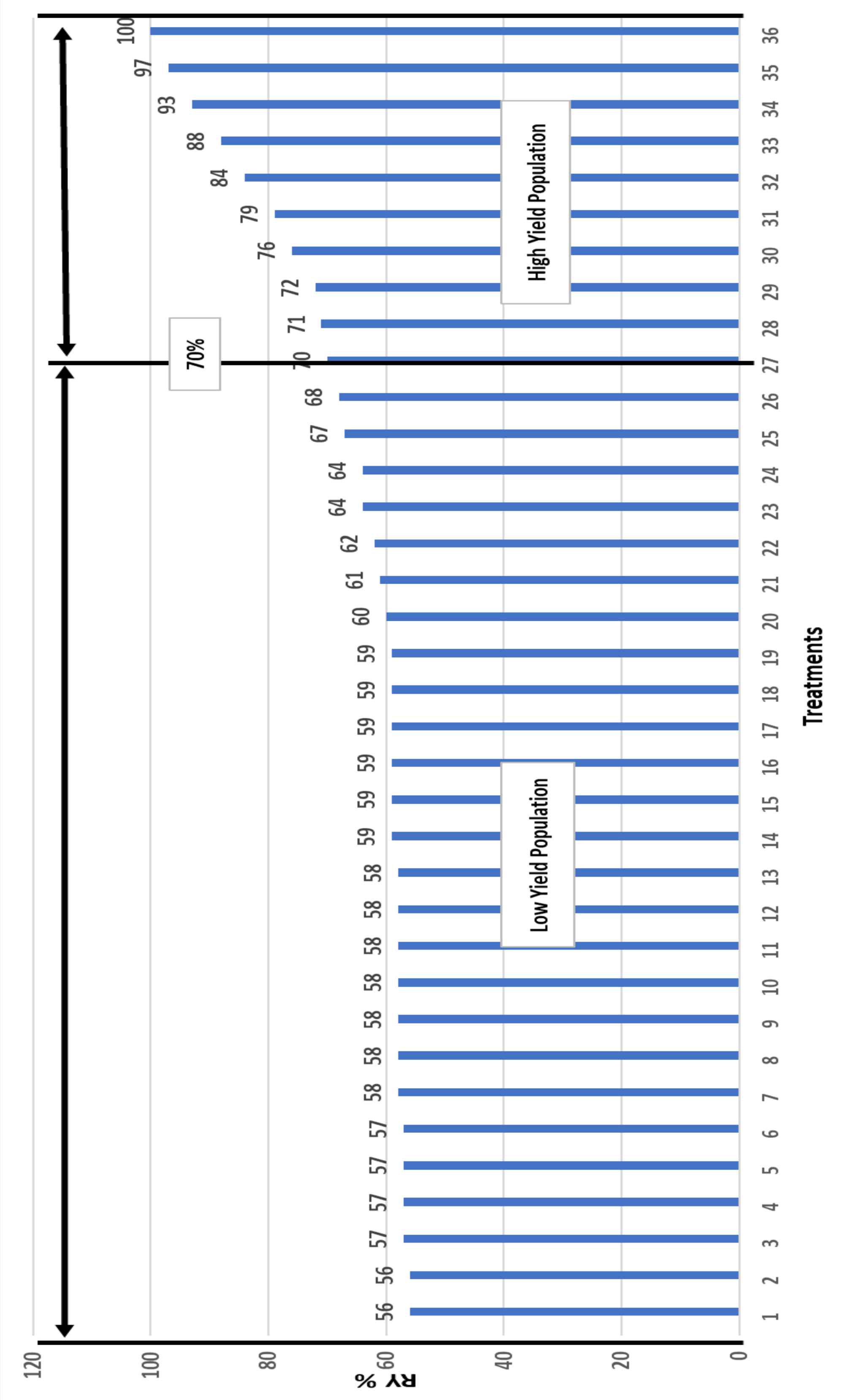

Figure 2 dividing the Rrelative Yield to subpopulations and combination effect of (NPK) on Onion Yield

Figure (2) shows the combination effect of (NPK)fertilizer on the Onion Yield,

So we notice increasing in Onion – Yield after the application of these Nutrients to our Calcareous soil [33], [34] and it describes the division of sub – population to High – Yield Population which include the Onion Relative-

Yield(RY%) more than 70% and Low – Yield population that represent the RY% lower than 70%.

Conclusion

The Nutrient – application(50 Kg $_{K2o.}$ ha^{-1} + 160 Kg $_{p2o5.}$ ha^{-1} + 40 Kg N. ha^{-1}) for the treatment combination (K1P2N1) had highest – Yield (18.36 Mg. ha^{-1}) and Relative – Yield (100%) so this treatment was the most balance treatment among the studied experiment units with DRIS– Indexes (-2.69, -1.01, - 0.82 and 4.52) for (N.P.K.S) respectively and lowest absolute total (9.04) .In the treatment(K0P0N0) Nutrient– Indexes values of the Nitrogen and Sulfur were sufficient for Onion crop, while Phosphorus and Potassium were deficient .The highest NBI (nutrient balance index) was for the (K0P0N0) treatment (73.18).(61 %) Sulfur– indexes, (56%) Nitrogen - indexes, (42%) Phosphorus – indexes and (36 %) Potassium-indexes for the treatment combination have positive - values the others have negative-values .

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اضافة مستويات من سماد(N.P.K) لمحصول البصل واستعمال نظام التشخيص والتوصيات المتكامل- DRIS

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الخلاصة

اجريت التجربة في الحقل التجريبي لكلية علوم الهندسة الزراعية، جامعة صلاح الدين في حقل كرده ره شه –اربيل –العراق، 3.5 كم جنوب اربيل، استخدم تصميم Split – Split design في التجربة. العامل الاول هو النيتروجين بأربعة مستويات (0، 40، 80، 160 كغم.هكتار$^{-1}$)، العامل الثاني هو الفسفور ثلاثة مستويات (0، 80، 160 كغم.هكتار$^{-1}$) والعامل الثالث هو البوتاسيوم ثلاثة مستويات (0، 50، 100 كغم.هكتار$^{-1}$) وبثلاثة مكررات، وبذلك اصبح عدد الوحدات التجريبية (108) وحدة تجريبية، اضيف الكبريت بشكل ثابت الى كل المعاملات بدون تحيز. التسميد هي احدى السبل من اجل زيادة انتاج ونوعية المحاصيل والخضر. معدلات اسمدة النيتروجين، الفسفور والبوتاسيوم المستخدمة في انتاج البصل مفرطة، لذا العناصر الغذائية في التربة قد تكون غير متوازنة، الاتزان الغذائي تحدد انتاج المحاصيل ونوعيتها. هذا البحث يهدف الى تقييم انتاجية محصول البصل باستخدام مستويات مختلفة من اسمدةالنايتروجين، الفسفور والبوتاسيوم لتعيين القيم القياسية ودليل الاتزان الغذائي لنظام التشخيص والتوصيات المتكامل باستخدام تحليل الاوراق. نظام التشخيص والتوصيات المتكامل تعتمد على العلاقة المتبادلة بين العناصر الغذائية حيث يقارن نسب العناصر الغذائية للمحصول مع القيم القياسية لهذا النظام وبذلك يمكن معرفة عدم التوزان، والنقص او الزيادة للعناصر الغذائية للنبات، اظهرت النتائج ان افضل توليفة سماديه والتي سجلت اعلى انتاج للبصل (36. 18 كغم .هكتار$^{-1}$) كانت 50 Kg K. ha^{-1} + 160 Kg P. ha^{-1} + 40 Kg N. ha^{-1} والتي كانت لها اوطئ دليل اتزان غذائي NBIالتي كانت (04. 9) ، بينما كانت القيمة لمعاملة المقارنة (73.18) وهي اعلى قيمة بين المعاملات التجريبية، حيث ان دليل الاتزان الغذائي هو حاصل جمع دليل العناصر الغذائية (NPKS)بغض النظر عن الاشارة موجبة او سالبة .

الكلمات المفتاحية: نظام التشخيص والتوصيات المتكامل، تحليل الاوراق، التوازن الغذائي، البصل