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DETERMINATION OF THE SUITABILITY OF DESERT LANDS IN KARBALA PROVINCE FOR GROWING WHEAT AND MAIZE USING GEOSPATIAL TECHNOLOGIES

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ABSTRACT

A part of desert lands in Karbala province was selected to study the suitability of these lands for growing wheat and maize crops using geospatial technologies in an area of 3363 dunums. The information about soils in the studied area was collected and soil characteristics were estimated in 50cm depth of soil surface. Results of chemical and physical analyses showed that soil characteristics were suitable for agriculture use if a good management system is applied. The research showed that studied soils has neutral pH or slightly basic between (7-7.52), low salt content as the values of EC ranged between 1.05 to 2.4 ds/m, with sandy – loamy, loamy – sandy texture (LS – SL), low organic material content (0.15 – 0.56%), and ion exchange capacity from 3.04 to 7.52 cmolc/kg. Results also showed that the gypsum content was higher (8.76 – 23.6 %) and the percentage of lime was 5.6 – 32 %, while the exchangeable sodium percentage ranged between 6.30 to 7%. The suitability of soil values were calculated using the average traits method. The results of evaluation showed that studied area located within S1 and S2 about 5.8%, 38.46% and 94%, 61.54% of total area for wheat and maize crops respectively despite of factors (moderate, middle) which presented as (texture, organic carbon, cation exchangeable capacity CEC and lime) and (severe) as gypsum.
***Keywords*: Land evaluation, desert, GIS system, wheat.**

Introduction

Desert lands occupy wide areas of Iraq estimated in 168522 km^2 which is about 39% 0f total area of the country (Central Statistical Organization, 1996). These lands distributed in a number of Iraqi provinces including Karbala in which the desert areas constitute a high percentage estimated in 85% of the total province area (5034 km^2) and most of these areas occupy the geographic area from Najaf borders in the south to Al-Tar low earth in the west and from Karbala – Najaf road in the east. The geospatial borders of desert area of Karbala located between 32,50,10 latitudes North and 34.9,32 South, and between longitudes 39,8,43 West and 12,15,44 East (Al-Kuzaey, 2018). These vast areas has to be evaluated to demonstrate suitability for cultivation, as valuing lands for agricultural use is the essential link in the agricultural development process. Many studies have been conducted to evaluate lands for agricultural purposes, for instance, Al-Shafaey, (2010) used geographic models to evaluate the suitability of lands for growing wheat, barley and maize using the American system (NCCPI, 2008) and special geographic model SYS *et al.* (1993) in order to monitor changes in the nature of land use in Al-Salameyat irrigation project in Western Baghdad where he was concluded that salinity was the most determining factor for agriculture. Saremi *et al.* (2011) evaluated the suitability of soils to produce wheat, barley and maize in Iran using GIS system to indicate the suitability requirements of crops as well as the characteristics of the land using maps to increase accuracy, where the results showed that organic matter, rocks and calcium carbonate were the most important determinants of crop cultivation. While, Rosa *et al.* (2004) mentioned that soil protection requires better use of agricultural land in terms of its planning and management, also the evaluation of land is consider an interaction between the sources of land and its surveys in order to use and manage land.

The most important soil characteristics are topography, soil and climate which considered essential in any evaluation and the main soil characteristics are texture, internal drainage, salinity, CEC, soil depth and pH (Ritung *et al.*, 2007). Another study by ALbaji, (2012) reported that texture, salinity, alkalinity and drainage factor were the most important determinants of crop cultivation when he evaluated Hedajen region in West Iran. The evaluation of east Saedia project for climate factors and soil suitability and sunflower showed high values (S1) for growing wheat, barley, sunflower and moderate (S2) for maize (Mohammed, 2013). Using remote sensing technology is one of modern methods to study nature resources (water and soil), identifying their characteristics, locations and developing the necessary plans to take advantage from these resources, in addition to its applications in monitoring the natural phenomena that affecting agricultural development processes due to its distinctive, natural and temporal capabilities (Al-Musawy, 2001). Goswami *et al.* (2012) and Rabia, (2012) were used remote sensitivity tools to study wheat and other crops and it was effective in the distribution of crop and different lands.

Materials and Methods

The studied area is located in Karbala province beside Najaf borders and about 32km from city center. Geographical coordinates were N 409677 E 3585223, N 406690 E 3584074, N 407839 E 3581088 and N 410826 E 3582236 with a total area of 3363 dunums. The climate of this area characterized as a hot and dry in summer and cold rainy in winter with annual average of temperature 24.2^{0}C, rainfall rate 96 mm, average relative humidity 43% and the rate of wind speed 2m/second. All these climate information was collected in a period from 1991-2019.

A survey method was used to collect 52 soil samples; the distance between each sample was 400m. Samples were reached by GIS system and taken by uker at 50cm depth. Physical characteristic (texture) was measured using hydrometer method which mentioned by Bouyoucos, (1962) after removing bind materials in soil, while the chemical characteristics were estimated as follows: EC in the extract of soil + water (1:1 soil: water) was estimated using Richards, (1954) procedure, pH was estimated following Mclean, (1982), calcium carbonate (lime) was estimated by measuring emitted CO_2 gas (Loeppert and Suareze, 1996), the organic matter was estimated by wet oxidation method (Walkely and Black) that mentioned in Jackson, (1958), gypsum was estimated through the precipitation by acetone then the electrical conductivity of the precipitate (Richards, 1954) and the CEC was estimated by titration with methylene blue (Savant, 1994).

The evaluation of suitability of soil for growing wheat and maize was determined according to SYS *et al*., (1993) as follows:

L.S = (A + B + C + ……. + F) / Number of properties

(A, B, C…..) were presented soil characteristics, in addition to adopt geographic information system (GIS) to prepare suitability maps using V.10 Arg.Map program.

Results and Discussion

Results of physical and chemical analysis of soil characteristics (Table 1) in the studied area showed that neutral pH or slightly basic between (7-7.52), low salt content as the values of EC ranged between 1.05 to 2.4 ds/m , with sandy – loamy, loamy – sandy texture (LS – SL), low organic material content (0.15 – 0.56%), and ion exchange capacity from 3.04 to 7.52 cmolc/kg. Results also showed that the gypsum content was higher (8.76 – 23.6 %) and the percentage of lime was 5.6 – 32 %, while the exchangeable sodium percentage ranged between 6.30 to 7%. The suitability of soil characteristics in the studied area was evaluated for growing wheat crop and results showed that depth trait was recorded 100% suitability in all samples and this trait is not determinants of crop cultivation (Table 2). While texture trait was recorded 50% suitability in all tested samples and then considered as moderate determinants of agriculture. Mineral carbonate trait was recorded 90 – 100% suitability in all samples except for (4, 16 and 17) samples which recorded 80% and this confirm that mineral carbonate considered as a determinants of agriculture in all studied areas and as moderate determinants in (4, 16 and 17) samples. Cation exchange capacity (CEC) trait was recorded 70% suitability and considered as moderate determinants of agriculture. The organic carbon recorded 75% in all samples except for (31) point which recorded 85% suitability. Whereas, EC, ESP and rocks traits were recorded 100% and these traits are not determinants of crop cultivation, while regression trait was recorded 99.5 – 100% suitability and this trait is not determinants of crop cultivation. Calcium sulfate (gypsum) trait was recorded 80% suitability in (43, 44) samples and then considered as moderate determinants of agriculture, while (5, 7, 27, 30, 36, 39, 42, 45 and 51) samples were recorded 50% suitability and also considered as moderate determinants, and 25% of suitability recorded for (1, 4, 8, 26, 29, 37, 38 and 52) samples which considered a sever determinants of agriculture. According to evaluation above soil characteristics in the studied area were classified to S1 (high suitability) with 5.8% of total studied area, S2 (moderate suitability) with 94.2% of total studied area (Fig 1).

The suitability of soil characteristics in the studied area was evaluated for growing maize crop and results showed that depth trait was recorded 100% suitability in all samples and this trait is not determinants of crop cultivation (Table 3). While texture trait was recorded 75% suitability in all tested samples and then considered as moderate determinants of agriculture. Mineral carbonate trait was recorded 90 – 100% suitability in all samples except for (4, 16 and 17) samples which recorded 80% and this confirm that mineral carbonate considered as a determinants of agriculture in all studied areas and as moderate determinants in (4, 16 and 17) samples. Cation exchange capacity (CEC) trait was recorded 50% suitability and considered as moderate determinants of agriculture. The organic carbon recorded 75% in all samples except for (31) point which recorded 85% suitability. Whereas, EC, ESP and rocks traits were recorded 100% and these traits are not determinants of crop cultivation, while regression trait was recorded 99.5 – 100% suitability and this trait is not determinants of crop cultivation. Calcium sulfate (gypsum) trait was recorded 80% suitability in (43, 44) samples and then considered as moderate determinants of agriculture, while (5, 7, 27, 30, 36, 39, 42, 45 and 51) samples were recorded 50% suitability and also considered as moderate determinants, and 25% of suitability recorded for (1, 4, 8, 26, 29, 37, 38 and 52) samples which considered a sever determinants of agriculture. According to the evaluation above soil characteristics in the studied area were classified to S1 (high suitability) with 38.46% of total studied area, S2 (moderate suitability) with 61.54% of total studied area (Fig 2).

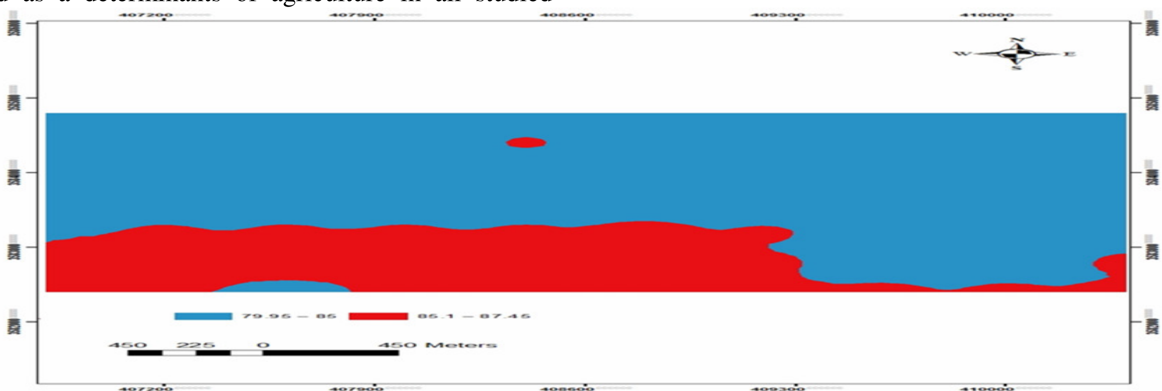

Fig. 1 : Shows the suitability of soils in the studied area to growing wheat crop

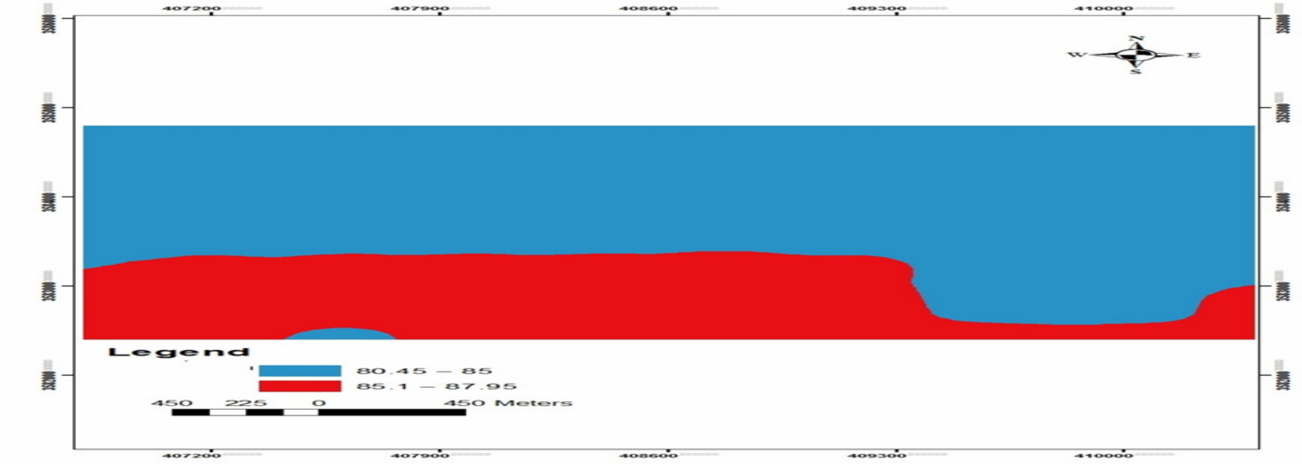

Fig. 2 : Shows the suitability of soils in the studied area to growing maize crop

Table 1 : Chemical and physical analysis of studied area soils.

ESP %	Lime %	Gypsum %	O.M %	CEC cmol/kg	Clay gm/kg	Loamy gm/kg	Sand gm/kg	Texture	Rocks %	EC d.s/m	PH	y	x	Point number
6.32	9.2	22.36	0.23	6.71	100	100	800	LS	0	1.99	7.35	3584800	409600	**1**
6.32	16.8	22.36	0.19	3.46	100	100	800	LS	2	1.766	7.03	3584800	409200	**2**
6.44	24.4	21.98	0.23	3.36	60	120	820	LS	1	1.79	7.01	3584800	408800	**3**
6.56	32	21.6	0.27	3.27	80	160	760	SL	0	1.814	7	3584400	409600	**4**
6.57	29.6	19.32	0.24	3.65	60	80	860	LS	0	1.076	7.2	3584400	409200	**5**
6.59	27.2	17.04	0.21	3.04	80	120	800	LS	0	1.339	7.4	3584400	408800	**6**
6.47	17.2	19.32	0.18	3.32	96	64	840	LS	2	1.368	7.4	3584400	408400	**7**
6.35	7.2	21.6	0.15	3.6	100	80	820	LS	0	1.397	7.42	3584400	408000	**8**
6.68	13.2	21.2	0.18	3.41	96	104	800	LS	1	1.66	7.33	3584400	407600	**9**
7.01	19.2	21.6	0.22	3.23	60	80	860	LS	0	1.935	7.25	3584000	410000	**10**
6.7	19.6	22.3	0.2	3.19	116	64	820	LS	0	1.66	7.17	3584000	409600	**11**
6.4	20	23.6	0.22	3.15	80	140	780	LS	0	2.4	7.09	3584000	409200	**12**
6.53	22.4	22.6	0.27	3.74	100	100	800	LS	1	2.05	7.14	3584000	408800	**13**
6.67	24.8	21.6	0.33	4.34	80	100	820	LS	1	1.719	7.11	3584000	408400	**14**
6.6	28.4	21.02	0.35	4.43	60	80	860	LS	0	1.947	7.31	3584000	408000	**15**
6.59	30.5	20.68	0.36	5.97	80	100	820	LS	1	1.5615	7.41	3584000	407600	**16**
6.56	32	20.44	0.37	7.52	60	120	820	LS	0	1.176	7.52	3584000	407200	**17**
6.69	22.6	22	0.31	4.2	60	120	820	LS	0	1.28	7.45	3584000	406800	**18**
6.7	12.8	23.6	0.22	3.78	60	140	800	LS	0	1.376	7.43	3583600	410000	**19**
6.57	11.4	22.1	0.25	3.98	60	80	860	LS	0	1.05	7.4	3583600	409600	**20**
6.46	9.6	23.6	0.28	4.16	96	64	840	LS	0	1.725	7.24	3583600	409200	**21**
6.38	10.4	22.47	0.24	3.88	80	100	820	LS	2	1.66	7.23	3583600	408800	**22**
6.3	11.2	21.34	0.2	3.6	96	64	840	LS	1	1.81	7.22	3583600	408400	**23**
6.32	15.6	21.04	0.27	4.16	60	80	860	LS	1	1.62	7.27	3583600	408000	**24**
6.33	20	20.74	0.34	4.72	96	64	840	LS	2	1.644	7.32	3583600	407600	**25**
6.37	20.4	20.14	0.28	4.03	116	84	800	LS	1	1.9	7.39	3583600	407200	**26**
6.42	20.8	19.54	0.22	3.34	76	64	860	LS	0	1.161	7.46	3583200	410400	**27**
6.42	15.6	20.67	0.23	3.27	100	100	800	LS	0	1.177	7.34	3583200	410000	**28**
6.43	10.4	21.8	0.26	3.22	96	64	840	LS	0	1.194	7.22	3583200	409600	**29**
6.39	15.3	16.22	0.27	3.78	80	100	820	LS	0	1.94	7.1	3583200	409200	**30**
6.47	17.7	13.43	0.56	4.1	80	100	820	LS	0	1.35	7.3	3583200	408800	**31**
6.36	20	10.64	0.29	4.34	96	64	840	LS	0	1.68	7.1	3583200	408400	**32**
6.7	18.2	12.5	0.24	3.75	96	64	840	LS	1	1.96	7.24	3583200	408000	**33**
6.66	17.5	13.5	0.21	3.45	96	64	840	LS	1	1.6	7.12	3583200	407600	**34**
6.62	16.8	14.44	0.18	3.15	96	44	860	LS	1	1.234	7.23	3583200	407200	**35**
6.72	16	18.5	0.24	3.41	96	104	800	LS	1	1.447	7.38	3582800	410400	**36**
6.54	14.8	20.3	0.23	3.6	116	84	800	LS	0	1.31	7.23	3582800	410000	**37**
6.35	13.6	22	0.21	3.78	116	64	820	LS	0	1.167	7.35	3582800	409600	**38**
6.41	12.8	16.4	0.23	3.47	116	24	860	LS	0	1.56	7.28	3582800	409200	**39**
6.44	12.4	13.53	0.23	3.31	96	64	840	LS	0	1.76	7.32	3582800	408800	**40**
6.45	12.2	12.1	0.26	3.23	76	64	860	LS	0	1.85	7.26	3582800	408400	**41**
6.45	12	10.66	0.24	4.15	96	64	840	LS	2	1.953	7.2	3582800	408000	**42**
6.66	16	9.7	0.3	3.53	96	84	820	LS	2	1.57	7.13	3582800	407600	**43**
6.77	20.8	8.76	0.28	3.9	116	24	860	LS	1	1.18	7.25	3582800	407200	**44**
6.3	5.6	11.34	0.3	3.41	96	84	820	LS	1	1.685	7.22	3582400	410400	**45**
6.63	9.5	12.4	0.29	3.32	96	84	820	LS	1	1.45	7.34	3582400	410000	**46**
6.79	11.6	12.89	0.31	3.27	116	84	800	LS	1	1.34	7.36	3582400	409600	**47**
6.95	13.6	13.48	0.27	3.21	116	64	820	LS	0	1.212	7.38	3582400	409200	**48**
6.79	11.4	13.9	0.32	3.7	116	24	860	LS	0	1.1	7.41	3582400	408800	**49**
6.56	9.2	14.44	0.33	4.27	116	24	860	LS	1	2.11	7.23	3582400	408400	**50**
6.49	13.1	17.43	0.28	4.4	116	84	800	LS	1	1.8	7.14	3582400	408000	**51**
6.4	16.8	20.42	0.22	4.44	116	84	800	LS	1	1.708	7.24	3582400	407600	**52**

Table 2. The classification of suitability lands for growing wheat.

Suitability	Score	Gypsum	Slope	ESP	EC	Organic Carbon	Apparent CEC	Lime	Texture	Coarse Fragment	Soil Depth	SMU
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	1
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	2
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	3
S2	79.95	25	99.5	100.00	100.00	75	70	80.00	50	100	100	4
S2	83.45	50	99.5	100.00	100.00	75	70	90.00	50	100	100	5
S2	83.45	50	99.5	100.00	100.00	75	70	90.00	50	100	100	6
S2	84.45	50	99.5	100.00	100.00	75	70	100.00	50	100	100	7
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	8
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	9
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	10
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	11
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	12
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	13
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	14
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	15
S2	79.95	25	99.5	100.00	100.00	75	70	80.00	50	100	100	16
S2	79.95	25	99.5	100.00	100.00	75	70	80.00	50	100	100	17
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	18
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	19
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	20
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	21
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	22
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	23
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	24
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	25
S2	80.95	25	99.5	100.00	100.00	75	70	90.00	50	100	100	26
S2	83.45	50	99.5	100.00	100.00	75	70	90.00	50	100	100	27
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	28
S2	79.95	25	99.5	100.00	100.00	75	70	100.00	50	80	100	29
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	30
S1	85.45	50	99.5	100.00	100.00	85	70	100.00	50	100	100	31
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	32
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	33
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	34
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	35
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	36
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	37
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	38
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	39
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	40
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	41
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	42
S1	87.45	80	99.5	100.00	100.00	75	70	100.00	50	100	100	43
S1	86.45	80	99.5	100.00	100.00	75	70	90.00	50	100	100	44
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	45
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	46
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	47
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	48
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	49
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	50
S2	84.50	50	100	100.00	100.00	75	70	100.00	50	100	100	51
S2	81.95	25	99.5	100.00	100.00	75	70	100.00	50	100	100	52

Table 3 : The classification of suitability lands for growing maize.

Suitability	Score	Gypsum	SLOPE	ESP	EC	Organic Carbon	Apparent CEC	$CaCO_3$	Texture	Coarse Fragment	Soil Depth	SMU
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	1
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	2
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	3
S2	80.45	25	99.5	100.00	100.00	75.00	50	80.00	75	100	100	4
S2	83.95	50	99.5	100.00	100.00	75.00	50	90.00	75	100	100	5
S2	83.95	50	99.5	100.00	100.00	75.00	50	90.00	75	100	100	6
S2	83.95	50	99.5	100.00	100.00	75.00	50	90.00	75	100	100	7
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	8

S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	9
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	10
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	11
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	12
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	13
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	14
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	15
S2	80.45	25	99.5	100.00	100.00	75.00	50	80.00	75	100	100	16
S2	80.45	25	99.5	100.00	100.00	75.00	50	80.00	75	100	100	17
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	18
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	19
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	20
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	21
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	22
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	23
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	24
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	25
S2	81.45	25	99.5	100.00	100.00	75.00	50	90.00	75	100	100	26
S2	83.95	50	99.5	100.00	100.00	75.00	50	90.00	75	100	100	27
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	28
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	29
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	30
S1	85.95	50	99.5	100.00	100.00	85.00	50	100.00	75	100	100	31
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	32
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	33
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	34
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	35
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	36
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	37
S2	82.45	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	38
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	39
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	40
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	41
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	42
S1	87.95	80	99.5	100.00	100.00	75.00	50	100.00	75	100	100	43
S1	86.95	80	99.5	100.00	100.00	75.00	50	90.00	75	100	100	44
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	45
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	46
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	47
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	48
S1	850.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	49
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	50
S1	85.00	50	100	100.00	100.00	75.00	50	100.00	75	100	100	51
S2	824.50	25	99.5	100.00	100.00	75.00	50	100.00	75	100	100	52

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