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Simple assessment of wind erosion depending on the soil texture and threshold wind velocity in reclaimed tidal flat land

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Abstract

The objectives of this paper were to simply estimate soil loss levels as caused by wind in reclaimed tidal flat land (RTFL) and the threshold wind velocity in the RTFL. For this experiment, RTFL located at Haenam Bay was selected and a total of 150 soil samples were collected at the Ap horizon from the five soil series. The particle distribution curves, including the limit of the non-erodible particle size (D > 0.84 mm) for each Ap horizon soil, show that the proportions of non-erodible particle sizes that exceeded 0.84 mm were 4.3% (Taehan, TH), 8.9% (Geangpo, GP), 0.5% (Bokchun, BC), 1.6% (Poseung, PS) and 1.4% (Junbook, JB), indicating that the amount of non-erodible soil particles increased with an increase in the sand content. The average monthly, daily and instantaneous wind velocities were higher than the threshold friction velocity (TFV) calculated according to the dynamic velocity (V_d) by Bagnold, while the average monthly wind velocity was lower than those of the TFV suggested by the revised wind erosion equation (RWEQ) and wind erosion prediction system (WEPS). The susceptible proportions of erodible soil particles from the Ap horizon soil samples from each soil series could be significantly influenced by the proportion of sand particles between 0.025 and 0.5 mm (or 0.84 mm) in diameter regardless of the threshold wind velocity. Thus, further investigations are needed to estimate more precisely soil erosion in RTFL, which shows various soil characteristics, as these estimations of soil loss in the five soil series were obtained only when considering wind velocities and soil textures.

Keywords: reclaimed tidal flat land, soil texture, threshold wind velocity, wind erosion

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Introduction

Soil wind erosion which is a complex geomorphic process governed by a large number of variables is caused by a strong, turbulent wind blowing across an unprotected soil surface that is smooth, bare, loose, dry, and finely granulated. Major factors that affect the amount of erosion are soil cloddiness, surface roughness, wind speed, soil moisture, field size, and vegetative cover.

Most of the reclaimed tidal flat lands (RTFL) which are located along the western coastal line in Korea are characterized as mainly sandy soils with extremely low organic matter content in addition to very poor surface vegetation due to soil physical and chemical properties and high salinity (Chung et al., 2012). Especially, silt content in surface horizon showing structureless and massive soil structures is greater than 57%, that can be subjected be easily eroded by wind during late fall and early spring. However, few studies have attempted to quantify erosion rates in the region of RTFL. This implies that there is a need to have specific soil erosion information about RTFL to support timely information for soil conservation planning. The challenge of precisely estimating wind erosion at a regional scale in RTFL still remain to date.

One of the direct consequences of wind erosion is the loss of soil and associated soil nutrients through saltation for particles between 0.1 and 0.5 mm and through suspension (vertical emission) of finer particles less than 0.1 mm in diameter. The wind erosion prediction models use a unique annual threshold wind velocity value to differentiate periods with high speed winds, which can erode the soil, from calm periods. Chepil and Woodruff (1963) state that the positive pressure on a soil particle being exerted by a moving air is the threshold drag and lift. The threshold wind velocity can be influenced by soil surface conditions including soil moisture, vegetative cover and roughness in addition to climatic factors including precipitation, temperature, evapotranspiration and relative humidity (Stout, 2003, 2004). Chepil (1958). He defined that the nonerodible fraction of the particle size was greater than 0.84 mm and the particle size smaller than 0.84 mm called as the erodible fraction. Based on the particle size suggested by Chepil (1958), Shao and Lu (2000) assumed that the wind speed that initiates soil movement is about 5.78 $m \cdot s^{-1}$, measured at a height of 30 cm above the ground surface for loose sand, whereas the Wind Erosion Prediction System (WEPS) uses a wind speed value of 8 $m \cdot s^{-1}$ (Wagner, 2004).

Few attempts were done to determine the possible variation of wind erosion under different climatic conditions existing within a year, nor tested its utility as an index of soil susceptibility variations to suffer wind erosion. The objective of this study was to calculate the variability of soil loss and the threshold wind velocity in the RTFL showing various soil textures in order to test its variations under different climatic conditions and soil characteristics to be used as an index of soil susceptibility to wind erosion.

Materials and Methods

Site description of experimental field

The selected study area, Sanyee II RTFL (latitude: 34.64197, longtude: 126.50364), was located on land within the Haenam bay in the south-western coast of Korea (Fig. 1). The size of RTFL which is consisted of five soil series with sloped from 0 to less than 0.10% is approximately 713 ha. The five soil series are Taehan (TH, coarse loamy, mixed, mesic family of Aquic Udorthents), Junbook (JB, fine, silty mixed, nonacid, mesic family of Typic Haplaquepts), Gwangpo (GP, coarse loamy, mixed, nonacid, mesic family of Fluventic Haplaquepts), Poseung (PS, fine silty, mixed, nonacid, mesic family of Typic Haplaquents), and Bokchun (BC, fine, silty mixed, nonacid, mesic family of Typic Haplaquepts) (RDA, 2017).

TH, PS and JB soil series were selected to estimate soil wind erosion as three representative soil series. The descriptions of Ap horizons for typical TH, PS and JB soil series were completed with total 90 undisturbed soil core samples (thirty samples from at each identifiable Ap horizon) in accordance with the procedures of the soil survey manual in Table 1 (Soil Survey Staff, 1999).

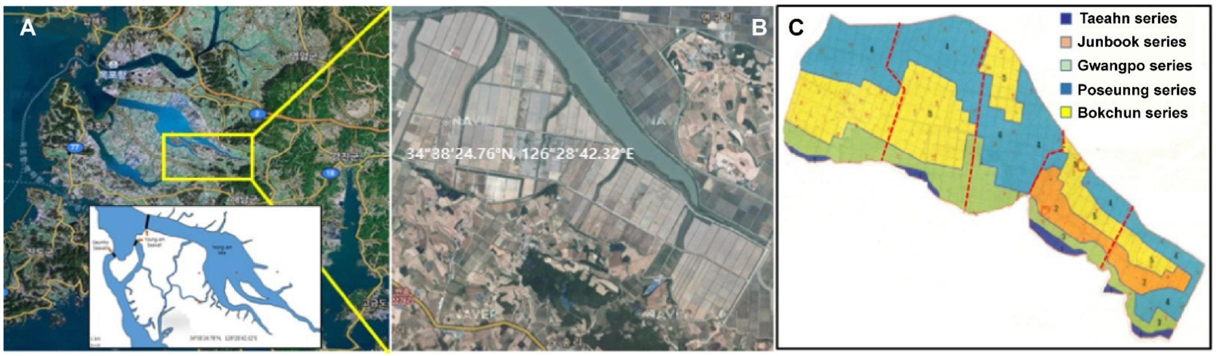

Fig. 1. Geographic location of reclaimed tidal flat land (RTFL) (A) and soil sampling site (B) for five soil series (C) at the Haenam Bay. Numerous dendritic streams (A) on the wide tidal flat land and main tidal channel (maximum depth of 25 m) comprise the coastal embayment.

Table 1. The description of Ap horizon of five soil series found in the investigation site.

Soil series	Depth (cm)	Soil texture	Soil color	Soil structure	Remarks
TH	0 - 27	Sandy loam	7.5YR 4/1	Single-grained, platy	Tiny quartz particles
GP	0 - 12	Sandy loam	10YR 4/4	Structureless	Manganese mottle
BC	0 - 15	Silty loam	5Y 4/1	Structureless	-
PS	0 - 12	Silty loam	2.5Y 4/2	Structureless	-
JB	0 - 19	Silty loam	5Y 4/1	Structureless, massive	Mica

TH, Taehan; GP, Gwangpo; BC, Bokchun; PS, Poseung; JB, Junbook; YR, Yellow green; Y, Yellow.

The soil particle distribution (SPD) and organic matter content (OM) were determined by hydrometer and Walkley-Black methods, respectively. Bulk density was determined after drying the samples at 105℃ for 48 h. The porosities were calculated based on the measured bulk density (BD) and particle density (2.65 $g \cdot cm^{-3}$) (Table 2). Soil texture across the RTFL ranges from sandy loam to silt loam, but approximately 65% of the RTFL is sandy loam that is fine, fragile and very susceptible to being blown. Winter wheat (or barley)/summer corn (or buckwheat) is the conventional crop rotation employed on most of the RTFL since it was developed in 2009.

Climatic conditions

The climatic data including wind speed during 2011 to 2020 was obtained from the nearest regional meteorological station (Haenam ASOS, latitude: 34.68719, longitude: 125.45105) (Table 3). The average monthly wind velocity was calculated by ten years' monthly wind velocity while the daily and instantaneous wind velocities were selected by minimum and maximum from ten year's records. Then, the average values of monthly, daily and instantaneous wind velocities were used to compare influence on the wind erosion.

Table 2. Soil physical properties of Ap horizons of three soil series selected as reference site for soil loss estimation in reclaimed tidal flat land (RTFL).

Soil series		Sand	Silt	Clay	Soil texture	OM	BD	Porosity
			(%)			(%)	(g·cm^{-3})	(%)
TH					Sandy loam			
	Min. - Max.	58.8 - 68.3	27.4 - 34.3	5.30 - 8.90		0.39 - 0.57	1.42 - 1.51	43.0 - 46.4
	Mean	63.6	29.5	6.87		0.48	1.47	44.7
	SD	4.53	3.54	1.80		0.09	0.05	1.70
	SE	0.87	0.65	0.33		0.02	0.01	0.31
GP					Sandy loam			
	Min. - Max.	66.5 - 70.9	18.5 - 24.3	7.99 - 9.10		0.29 - 0.43	1.47 - 1.53	42.8 - 44.4
	Mean	69.6	21.3	9.10		0.48	1.47	43.6
	SD	2.83	1.89	2.09		0.07	0.25	1.03
	SE	0.82	0.57	0.27		0.01	0.04	0.21
BC					Silty loam			
	Min. - Max.	5.38 - 6.75	73.5 - 78.4	16.2 - 20.3		0.62 - 1.03	1.37 - 1.43	46.4 - 49.4
	Mean	6.05	75.5	18.5		0.77	1.38	47.9
	SD	1.38	2.12	1.96		0.29	0.09	1.41
	SE	0.52	0.29	0.18		0.08	0.03	0.25
PS					Silty loam			
	Min. - Max.	13.8 - 21.2	52.9 - 62.9	21.1 - 29.1		0.71 - 1.23	1.34 - 1.42	46.4 - 49.4
	Mean	16.8	57.1	25.6		0.97	1.38	47.9
	SD	3.72	5.02	4.01		0.26	0.06	1.51
	SE	0.68	0.92	0.73		0.05	0.01	0.28
JB					Silty loam			
	Min. - Max.	7.90 - 11.6	63.4 - 74.2	17.8 - 26.2		0.84 - 1.05	1.35 - 1.44	45.7 - 49.1
	Mean	9.89	68.6	21.6		0.95	1.40	47.4
	SD	1.85	5.40	4.21		0.11	0.05	1.70
	SE	0.34	0.99	0.77		0.02	0.01	0.31

OM, organic matter; BD, bulk density; SD, standard deviation; SE, standard error; TH, Taeahn; GP, Gwangpo; BC, Bokchun; PS, Poseung; JB, Junbook.

Table 3. Monthly and daily average peak wind velocity measured at the nearby station and monthly temporal peak wind velocity from 2011 to 2020.

Month	Monthly average wind velocity (m·s^{-1})			Daily average peak wind velocity (m·s^{-1})			Instantaneous peak wind velocity (m·s^{-1})		
	Min	Max	Average	Min	Max	Average	Min	Max	Average
Jan.	1.82	2.75	2.29	6.71	11.8	9.25	12.7	19.9	16.3
Feb.	2.24	2.83	2.54	6.92	13.3	10.1	15.2	20.6	17.9
Mar.	2.12	2.77	2.45	6.31	10.6	8.45	13.8	18.9	16.4
Apr.	2.26	3.05	2.66	9.09	13.8	11.4	15.1	25.6	20.4
May	2.13	2.73	2.43	8.36	11.7	10.0	12.2	18.5	15.4
June	1.78	2.28	2.03	5.64	10.6	8.10	6.36	18.9	12.6
July	2.15	2.29	2.22	5.61	14.1	9.85	6.32	21.3	13.8
Aug.	1.48	2.63	2.06	6.22	14.1	10.1	11.2	23.2	17.2
Sep.	1.52	1.95	1.74	7.17	15.7	11.4	11.4	24.4	17.9
Oct.	1.44	2.43	1.94	6.36	14.5	10.4	13.3	25.6	19.5
Nov.	1.16	2.46	1.81	6.90	11.8	9.35	14.6	17.4	16.0
Dec.	1.63	2.58	2.11	7.22	12.4	9.80	14.9	17.2	16.1

Particle distribution

200 g soils collected at each Ap horizon were used to determine the sand particle size distribution by a dry sieving method with the six sets of American standard test method (ASTM) standard sieves (#10, 20, 35, 60, 140, 270). The mass of fragments remaining on each sieve after the process was used to calculate the proportion of fragment distribution, which were then normalized with respect to the total mass the proportion corresponding to D_{60}, D_{30}, and D_{10}. The equations which can be used to calculate the actual particle size depending on the proportion of the particle size distribution for each Ap horizon soil were obtained by exponential rise to maximum of dynamic curve fitting method with double 5 parameters with measured values of the particle proportion using Sigmaplot 12 (Systat Software Inc, Chicago, USA). The parameters and statistics for each equation were also obtained by interpolation by Sigmastat 12.

Statistical analysis

The standard deviations (SD) and standard error (SE) of SPD, BD, and porosity in Table 2 were calculated for each soil series whereas the Sigmastat was used to determine r^2 and p for the parameters of each equation corresponding to each particle distribution curve.

Results and discussions

Properties of Ap horizon soil

The depth of Ap horizon for three soil series ranges from 12 cm of PS soil series to 27 cm of TH soil series (Table 2). Soil textures of Ap horizon for five soil series are grouped into sandy loam for TH and GP soil series with higher sand content greater than 60% and less than 10% of clay content and silty loam for BC, PS and JB soil series with relatively higher silt content greater than 60% and clay content greater than 20% (Table 2). Thus, BC, PS and JB soil series are dominated by relatively high silt and clay contents compared with those of TH and GP soil series. The SD and SE of SPD for all soil series were less than 5.02 and 0.99, respectively. The mean organic matter contents for all soil series were less than 1% and highest SE was 0.09 from TH soil series. With these results, the mean values can represent the actual population mean.

The particle distribution curves including D_{60}, D_{30}, D_{10} and limit of non-erodible particle size (D > 0.84 mm) for each Ap horizon soil are represented in Fig. 2. The proportion of non-erodible particle size greater than 0.84 mm were 4.3% (TH), 8.9% (GP), 0.5% (BC), 1.6% (PS) and 1.4% (JB), indicating that the amount of the non-erodible soil particle increased with increasing sand content.

The all equations of particle distribution curves for the soil samples obtained by using dynamic curve fitting method can be expressed exponential rise as seen in eq. (1).

$$Y = Yo + a(1 - exp\,(-bx)) + c(1 - exp\,(-dx)) \tag{1}$$

Where a, b, c, and d are parameters, and Y_o and Y are the proportions for proportion at x = 0 and D_N, respectively, while x is the actual diameter corresponding to distribution percentage.

Then, the equation 1 was arranged to eq. (2) to calculate particle diameter corresponding to D_N that means proportion of particle size at which N% of the particles are finer and 100 - N % of the particles are coarser than D_N size.

$$X_{DN} = \frac{ln(ac) - ln(a + c + Y_o - Y)}{(b + d)} \tag{2}$$

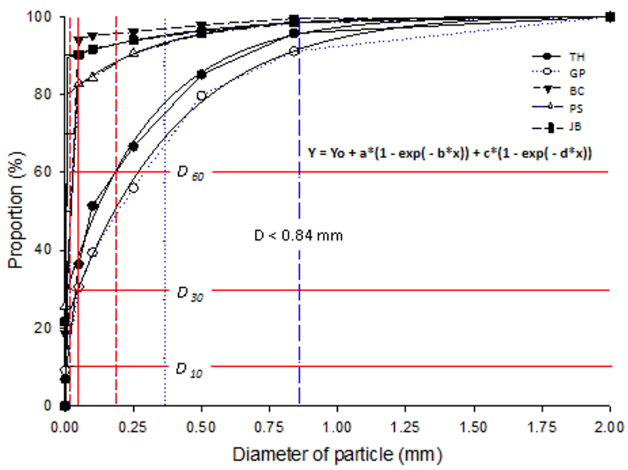

Fig. 2. Particle distribution curves of soils collected at Ap horizon for each soil series. TH, Taehan; GP, Gwangpo; BC, Bokchun; PS, Poseung; JB, Junbook.

The parameters obtained by dynamic curve fitting method with double 5 parameters for each Ap horizon soil in Table 4 showed that r^2 were greater than 0.99 with $p < 0.0001$, that indicate that equations applying these parameter can be used to properly calculate the actual particle size corresponding to the proportion of particle distribution for each Ap horizon soil.

The wind effect on the soil loss was observed by the relative comparison of monthly, daily and instantaneous wind velocity with annual vegetation cover change with single winter wheat cultivation followed by fallow in the RTFL was performed (Fig. 3). Then, three frictional wind velocity (FWV) groups as threshold wind velocity were determined by threshold values suggested by Fryrear et al. (1998a, b, 1999) and Hagen (2004). The average monthly wind velocity ranged from 1.95 to 2.83 $m \cdot s^{-1}$ with relatively high from January to May in this area except typhoon periods of July and August. Daily average peak wind velocity ranged from 8.44 to 10.7 $m \cdot s^{-1}$ with highest peak wind velocity of 15.7 $m \cdot s^{-1}$ recorded during fall typhoon period in October of 2018. However, instantaneous average peak wind velocity ranged from 12.9 to 18.3 $m \cdot s^{-1}$ with maximum 25.6 $m \cdot s^{-1}$ recorded in April of 2016 (Table 3).

Table 4. Overall parameters of equations obtained by dynamic curve fitting method with double 5 parameters.

Soil series	a	b	c	d	r^2	p
TH	20.8	2,864.0	79.9	2.51	0.998	< 0.0001
GP	28.1	1,395.5	72.1	3.21	0.996	< 0.0001
BC	79.5	1,942.6	20.6	3.01	0.994	< 0.0001
PS	89.3	1,384.0	10.89	2.13	0.998	< 0.0001
JB	96.7	1,257.2	9.67	1.99	0.991	< 0.0001

TH, Taehan; GP, Gwangpo; BC, Bokchun; PS, Poseung; JB, Junbook.

The frequencies of wind direction depending on the wind velocity classes showed that the most frequent wind class was 60.9% with range of 0.5 - 3.3 m·s^{-1} while the most frequent wind direction was NNW as of 8.70% (Table 5). And the frequency of wind direction was from North as of 34.5%. These results indicated that north is the wind direction with more erosive effects in this region. For wind velocity in Fig. 3, the average monthly wind velocity was much higher than 0.4 m·s^{-1} which is considered as a calm period that means no erosion of soil by wind. This aldo indicated that there is soil loss in the RTFL throughout year although the amount of soil loss is varied depending on the wind velocity except the factors that influence soil loss in the field. For vegetation cover in the field, there was little actual vegetation cover between harvest in the middle of June and end of October as of sowing seeds by seed planter due to removal of residue for animal feed followed by intermittent chisel and mold plow to control weeds. However, there was a rainy period between end of June to beginning of August, resulting in soil becomes wet (Fig. 3).

Table 5. Proportion of wind direction frequencies depending on the wind velocity classes measured at the nearby station from 2011 to 2020.

Wind velocity class (m·s^{-1})	C	N	NNE	NE	ENE	E	ESE	SE	SSE	S	NNW	NW	WNW	W	WNW	Total
$\geq$0.4	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3
0.5 - 3.3	0.0	4.9	3.5	2.9	4.3	4.8	3.6	2.3	1.6	1.6	5.9	6.8	4.3	6.7	7.7	60.9
3.4 - 7.9	0.0	2.3	0.9	0.3	0.7	1.6	1.7	1.8	0.5	0.2	2.8	1.8	1.3	1.2	3.4	20.5
8.0 - 13.8	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
Total	18.3	7.2	4.4	3.2	5.0	6.5	5.4	4.1	2.1	1.8	8.7	8.6	5.6	7.9	11.2	100.0

C, calm; E, east; W, west; S, south; N, north.

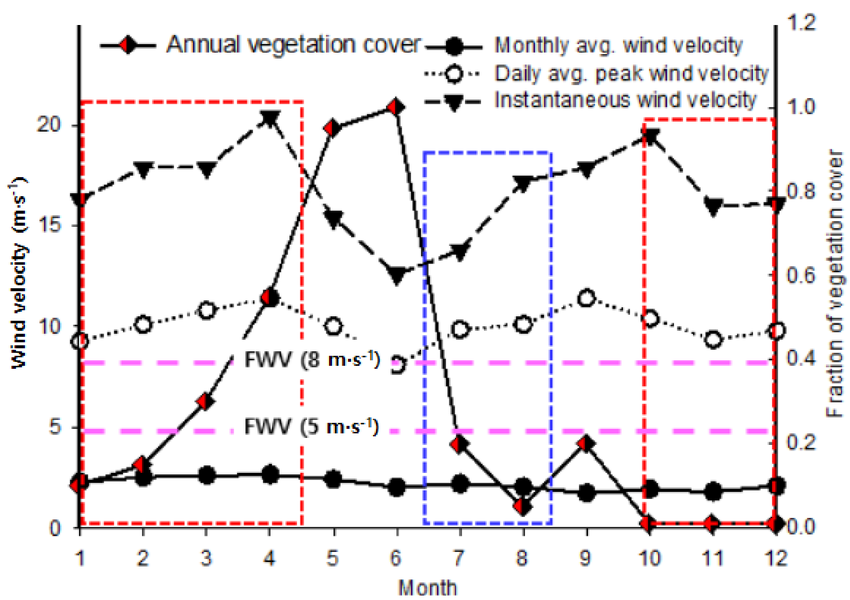

Fig. 3. Relative comparison of monthly, daily and instantaneous wind velocity with annual vegetation cover change with single winter wheat cultivation in the reclaimed tidal flat land (RTFL). Frictional wind velocity (FWV) as threshold wind velocity was divided into 2 groups based on revised wind erosion equation (RWEQ) and wind erosion prediction system (WEPS). Blue square box represents the rainy period from the middle of June to middle of August.

The wind erosion prediction models use a unique annual wind velocity value to differentiate periods with high speed winds, which can erode the soil, from calm periods. The Revised Wind Erosion Equation (RWEQ) assumes a wind velocity value of 5 $m \cdot s^{-1}$ (Fryrear et al., 1998a, b; Lee et al., 2020), whereas the WEPS uses a wind velocity value of 8 $m \cdot s^{-1}$ (Wagner, 2004). Daily and instantaneous wind velocities were much higher than those of both FWVs of RWE and WEPS although the monthly wind velocity was lower than those of RWEQ and WEPS. Therefore, we assume that the amount of soil loss can be influenced by daily and instantaneous wind velocities and duration of wind velocity in the field.

Saltation is the major process involved in the movement of soil particles by wind Bagnold (1941). According to Chepil's research, the jumping soil particles initially rotate before they jumped. Bagnold (1941) defined that particle detachment by wind erosion was identified as a two-stage event of the static threshold where the direct action of wind causes detachment and the second stage is the dynamic threshold where stationary particles are bombarded by moving particles while Chepil (1945a, b) suggested that there were three types of soil particle movements: (1) rolling of particles along surfaces; (2) particles that break away from the surface and then fall back down (jumping movements) and, (3) particles that remain airborne after initial separation from surface (Soo, 2001).

Wind erosion occurs when the wind speed reaches a threshold value above which it can carry particles. The threshold friction velocity (TFV) is the minimum friction velocity needed to start the soil particle movement, reflecting the capacity of an aeolian surface to resist against wind erosion (Batt and Peabody, 1999; Shao and Lu, 2000; Refahi, 2012; Sharratt and Vaddella, 2012). For the movement of soil particles on the soil surface, there are two types of velocity such as dynamic and static velocity. The dynamic velocity (V_d) is the velocity at which particles are moving as a result of bombardment from saltating and suspended particles. On the other hand, static velocity is the velocity at which that sand movement is caused only by fluid pressure. The dynamic velocity is;

$$\text{Dynamic velocity } (V_d) = 164\sqrt{r}\ cm \cdot s^{-1} \tag{3}$$

where V_d is the critical friction velocity and r is the radius of the particle

The V_d which is plotted on the ordinate axis against the radius of the soil particle on the abscissa showed that V_d exponentially rised and approached to maximum of 0.733 $m \cdot s^{-1}$ with increasing particle size. Compared with Bagnold's result in the desert (1941), V_d of 0.12 mm was 0.127 $m \cdot s^{-1}$ which was almost half of a threshold friction velocity of 0.23 $m \cdot s^{-1}$ measured at a height of 10 cm above the surface. The monthly, daily and instantaneous wind velocities observed in the RTFL were higher than V_d calculated by eq. (3), resulting in that the possibilities of soil loss caused by wind always present when soil texture is considered in this filed.

Bisal and Nielsen (1962) reported that most of the soil particles of less than 0.5 mm in diameter from an eroded soil surface could be removed and only soil particles larger than this remain on the soil surface. The radius of sand particles between 0.09 and 0.15 mm are four or five times more likely to be jumping than rolling while sand particles with a radius of 0.2 to 0.3 mm will not jump if the wind speed is less than 10 $m \cdot s^{-1}$ and 1 mm particles will not move at all (Soo, 2001). Chepil also suggested that soils with radius less than 0.025 mm and sands with radius greater than 0.5 mm hardly eroded at all due to the attractive forces between the particles. Further researches found that soils erode most readily for particle sizes with a radius of between 0.05 to 0.07mm, corresponding to a friction velocity between 3.6 to 4.0 $m \cdot s^{-1}$, measured at a height of 15 cm.

Table 6. Proportions of non-erodible and erodible soil particles from Ap horizon soil of each soil series.

Soil series	Proportion of non-erodible					Proportion of erodible		
	Particle size (mm)			Sum				
	< 0.025 (A)	> 0.5 (B)	> 0.84 (C)	(A + B)	(A + C)	D[x]	E[y]	0.05 - 0.07 mm (F[z])
TH	32.5	14.9	10.6	47.4	43.1	52.6	56.9	11.5
GP	26.7	2.03	11.4	28.7	38.1	71.3	61.9	6.99
BC	78.8	2.28	1.72	81.1	80.5	18.9	19.5	0.94
PS	68.4	4.48	2.93	72.9	71.3	27.1	28.7	1.24
JB	72.9	3.82	1.45	76.7	74.4	23.3	25.7	1.09

TH, Taehan; GP, Gwangpo; BC, Bokchun; PS, Poseung; JB, Junbook.

[x] Was obtained by subtraction of (A + B) from 100.

[y] Was obtained by subtraction of (A + C) from 100.

[z] Indicates the particle range which is easily erodible in the field.

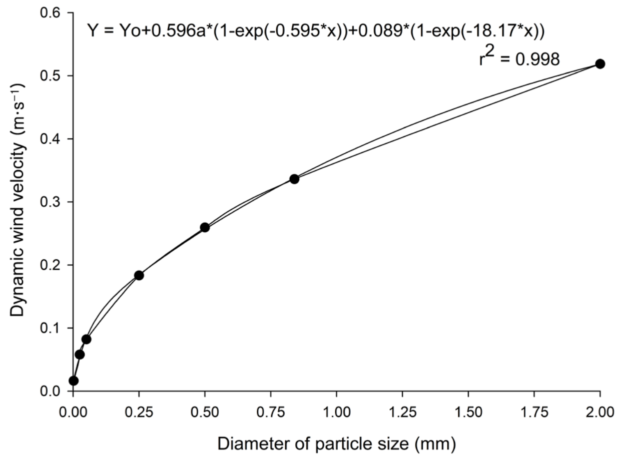

Fig. 4. Dynamic wind velocity depending on the diameter of particle.

The susceptible proportions of non-erodible and erodible soil particles from Ap horizon soil of each soil series was figured out by the proportion of particle distribution in Table 6. The proportions of the particle size less than 0.025 mm which was obtained by substitution of parameters into eq. (1) for each soil series corresponded to sum of silt and clay contents while the proportions of the particle size greater than 0.5 mm and 0.84 mm and 0.05 - 0.07 mm corresponded to sand content. The proportions of non-erodible soil particles increased with increasing silt and clay contents, showing that the highest proportion of the non-erodible soil particles was observed from BC soil series of which the sum of mean silt and clay content was approximately 94% while the lowest proportion of the non-erodible soil particles was observed from GP soil series of which the sum of mean silt and clay contents was approximately 30.4%. Considered the particle size between 0.025 mm and 0.5 mm (or 0.84 mm) in diameter as the ranges of erodible particle size, the proportion of the erodible soil particles was the highest in GP soil series (71.3%) while the lowest proportion was observed in BC soil series (18.9%). From this, we could conclude that the proportion of the erodible soil particles could be significantly influenced by the proportion of sand particle between 0.025 mm and 0.5 mm (or 0.84 mm) in diameter regardless of threshold wind velocity. But the proportions of the erodible particle with > 0.84 mm were slightly lower than those of proportions with particle size > 0.5 mm. From this, we could assume that the wind erosion is higher in the soil series containing higher sand content although these results were only obtained by considering particle sizes.

Conclusion

The precise estimation of accelerated soil wind erosion which deteriorates the soil quality with respect to arable land and causes severe economic and environmental impacts still remains to date in the reclaimed tidal areas in Korea. In this article, we estimated the probable proportion of soil loss depending on the soil textures for five different soil series which show different soil characteristics. The monthly, daily and instantaneous wind velocities in this area were higher than the threshold wind velocity to initiate the soil particle movement on the soil surface. The very poor vegetation cover with the winter wheat followed by fallow and removal of residue as the animal feed could not mitigate the wind effect on soil erosion. The dynamic velocity is the velocity at which particles are moving as a result of bombardment from saltating and suspended particles. The movement of the soil particles on the soil surface can be strongly influenced by the soil particle size. Generally, the radius of soil particles between 0.05 and 0.07 mm belonging to sand are known to be most readily eroded, corresponding to a friction velocity between 3.6 to 4.0 $m \cdot s^{-1}$, measured at a height of 15 cm. However, these estimation for soil loss by wind velocity and soil textures for five soil series cannot represent the actual results because other factors including precipitation, vegetation cover, wind barrier, and so on were not considered to estimate the soil loss by wind. Therefore, further investigations are needed to precisely estimate the soil erosion in the RTFL which show various soil characteristics.

Conflict of Interests

No potential conflict of interest relevant to this article was reported.

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