JEC1, a new variety of *Erianthus* with higher mechanical harvesting efficiency

The enhancement of production and utilization of bioenergy crops as energy sources would play an important role in reducing CO_2 emissions, improving local energy production, and stimulating local economy. *Erianthus* (*E. arundinaceus*), a wild relative of sugarcane, is a perennial tall herb of Gramineae with C_4 photosynthesis. Because of its high biomass productivity, it is considered a good candidate as feedstock for bioenergy production in Japan especially in sub-tropical areas. To realize practical utilization of *Erianthus*, the development of new varieties that will enable low cost production is indispensable. Thus, in 2014, the Japan International Research Center for Agricultural Sciences (JIRCAS) and the National Agriculture and Food Research Organization (NARO) registered JES1 (Japanese *Erianthus* Seed 1) as its first *Erianthus* variety. JES1 is a variety that can be propagated by botanical seeds. Although it improves the propagation efficiency of *Erianthus*, the stools are relatively less uniform in their growth, which leads to lower mechanical harvesting efficiency. Since mechanical harvesting cost is a major portion of total costs in biomass production, we developed this new variety, JEC1 (Japanese *Erianthus* Clone 1). JEC1 can be propagated vegetatively and demonstrates improved mechanical harvesting efficiency over the previous variety, JES1.

JEC1 was selected from the open pollinated population of JW4, a Japanese *Erianthus* germplasm accession that exhibits late flowering and an erect growth habit. Vegetative propagation of JEC1 was done by stem cutting or rhizome division. Its heading was in early October, 10 days earlier than JES1, and the germination rate of florets was 9.4% in Kumamoto Prefecture (Table 1). The plant had a relatively prostrated growth habit compared with JES1 (Table 1, Fig. 1), and the dry matter yield in the 2nd year was 3.16t/10a, which was almost equivalent to JES1. The coefficient of variance of stalk number and the dry matter weight per stool in JEC1 were significantly lower than in JES1 (Table 2); as a result, a significantly higher machine harvesting efficiency of 9.3t/hr was achieved, compared with the efficiency of JES1 which was 7.3t/hr (Fig. 2). It should be noted that JEC1 produces fertile seeds in the southern part of Japan, therefore cultivation of this variety in Ogasawara and Nansei Islands is not recommended due to the risk of weed invasion. However, cultivation poses no problem for the northern part of Kyusyu mainland.

In Japan, the utilization of bioenergy crops is still under study phase. JEC1 is being considered for use as a pioneer material in technical development, empirical research, and pilot projects leading to the practical utilization of *Erianthus*.

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Table 1. Major characteristics of JEC1 (Kumamoto Pref., NARO)

Characteristics[1)]	JEC1[2)]	JES1[3)]	KO2-erect[3)]	note
Plant type	5.1	3.0	5.5	(1 : erect - 9 : prostrate)
Leaf sheath hairiness	5.3	3.9	5.9	(1 : absent - 9 : very many)
Early growth (2nd year)	7.3	6.3	6.4	(1 : poor - 9 : very robust)
Plant length (cm)	418 a	396 a	371 b	2nd year (2013)
Culm diameter (mm)	14.8 a	14.2 a	14.3 a	2nd year (2013)
Stalk no. (no./a)	4751 a	4777 a	4959 a	2nd year (2013)
Dry matter yield (t/10a)	3.16 a	3.22 a	2.71 a	2nd year (2013)
Dry matter content (%)	42.6 a	39.1 a	50.4 b	2nd year (2013)
Ash content (%)	7.7 a	7.3 a	6.2 b	1st year (2012)
First heading date	10/8 a	10/18 b	9/30 c	2nd year (2013)
Germination rate [4)] (%)	9.4	0.1	11.9	2nd year (2013)

1) Different alphabets indicate significance at 5% level by Tukey's HSD.
2) Materials under test were propagated by tissue culture.
3) Check variety and clone
4) Calculated from the number of germinated florets over the total number of florets (Total floret number of JEC1, JES1, KO2-erect was 1451, 1352, and 1264, respectively.)

Fig. 1. JEC1 vs JES1

Table 2. Coefficient of variance in stalk number and dry matter weight per stool

Year	Variety[1)]	Stalk no.		Dry matter weight	
		no. /stool	CV	g /stool	CV
1st year	JEC1	133	18	1630	27
	JES1	86	38	1378	47
2nd year	JEC1	89	46	5923	50
	JES1	90	67	6031	80

Two-way ANOVA[2)]	*df*	*F*	*P*		*F*	*P*	
Variety (JEC1 vs JES1)	1	9.34	0.016	*	31.70	0.008	**
Year (1st vs 2nd)	1	16.46	0.004	**	27.98	0.006	**
Variety x Year	1	0.03	0.875	*ns*	5.50	0.499	*ns*
Error	8						

1) Results from 1st and 2nd year data of the performance test field planted on June 2012.
2) Data were collected from 5 stools in each replication (3 rep.).
3) Results of two-way ANOVA for calculating the coefficient of variance of each trait. * and ** indicate the significance at 0.01<P<0.05 and P<0.01, respectively. ns = not significant.

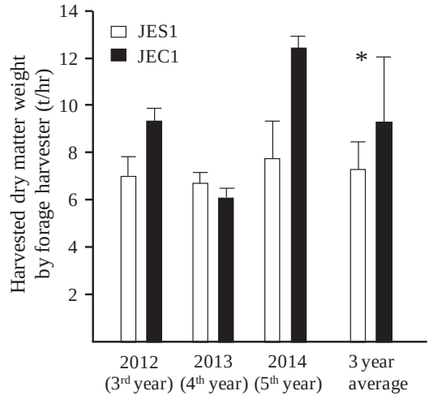

Fig. 2. Mechanical harvesting efficiency of JEC1

1) Harvested dry matter weight per hour by forage harvester ''CHAMPION 3000''
2) Data were collected from 3rd, 4th, and 5th year experimental fields planted in June 2010.
3) The drivers of the forage harvester were different in 2012 and 2013, 2014.
4) * indicate the significance at 5% level between varieties by two-way ANOVA (variety and year as factors of variation).