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Studies on After-barley-direct-sown Paddy Rice (*Oryza sativa* L.) and Analyses of Growth and Energy Efficiency in Different Cultural Patterns

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<實驗目的>

南部地方의 씨 麥後作 直播栽培 技術確立과 栽培樣式間的 物質生産 構造解析 및 에너지效率에 미치는 效果를 究明코자 함.

<材料 및 方法>

1984 - 1988年의 5個年間 씨 麥後作 直播栽培 技術確立을 위하여 播種期, 播種量, 播種距離, N 施肥量, 雜草防除, 倒伏防止, 適應品種, 播種深度에 관한 試驗을 圃場에서 遂行하였으며, 栽培樣式間的 物質生産 構造解析은 Watson의 生長解析法에 따라 分析하였고, 에너지效率 分析은 支持(Support) 에너지效率( $ER_{se} = O_i / I_i$ ,  $O_i$  = 作物의 生産에너지,  $I_i$  =  $O_i$ 를 生産하기 위한 投下에너지)과 太陽(Solar) 에너지效率( $ER_{sr} = O_i / I_{is}$ ,  $O_i$  = 作物의 生産에너지,  $I_{is}$  =  $O_i$ 를 生産하기 위한 太陽에너지)을 分析하였다.

<實驗結果 및 考察>

1. 南部地方 씨 麥後作 直播栽培에 있어서 5月 30日 前後에 一般型 品種인 八公벼로써 播種할 境遇 直播栽培가 可能하였고, 播種量은 6l/10a, 播種距離는 45 × 15cm, N施肥量은 19kg/10a, 適用除草劑는 Pyrazolate, 適應品種은 東海벼, 播種深度는 土中 1cm가 適正 播種深度였다.
2. 씨 直播栽培時 生育初期에 個體群 生長率(CGR), 相對生長率(RGR) 및 純同化率(NAR)이 移秧栽培에 비해 높았다.
3. 씨 直播栽培時 總農作業 時間이 短縮되므로써 勞動力 에너지와 太陽에너지效率이 機械移秧이나 手移秧보다 높았다.

Table . Some agronomic characters of direct-surface sown rice in paddy under different sowing date

Cultivars	Sowing date	Heading date	Culm length (cm)	No. of panicles per m <sup>2</sup>	No. of spikelets per m <sup>2</sup> (x1,000)	Filled grain ratio (%)	1,000-grain weight (g)	Milled rice yield (kg/ha)
Masryong-byeo	May. 5	Aug. 17	67 ± 1.70	394 ± 11.6	30.8 ± 0.71	83.1 ± 0.52	13.9 ± 0.23	364 ± 4.5
	May. 15	Aug. 17	71 ± 1.04	383 ± 15.3	30.0 ± 1.21	85.3 ± 1.14	19.8 ± 0.00	340 ± 7.8
Masryong-byeo	May. 25	Aug. 23	65 ± 0.07	343 ± 9.5	29.5 ± 0.34	77.7 ± 1.25	19.9 ± 0.07	324 ± 9.9
	Jun. 5	Aug. 29	57 ± 0.58	273 ± 6.8	24.8 ± 0.12	74.0 ± 2.53	19.5 ± 0.28	265 ± 2.3
LSD <sub>05</sub>								
C V %		-	3.37	41.03	2.70	5.17	0.81	26.94
C V %		-	2.82	5.90	4.70	3.23	2.06	4.11
Palgong-byeo	May. 5	Aug. 9	86 ± 0.66	418 ± 11.1	26.4 ± 1.42	86.6 ± 1.21	21.1 ± 0.35	344 ± 18.1
	May. 15	Aug. 13	86 ± 0.33	376 ± 38.4	25.9 ± 1.76	88.5 ± 0.73	20.5 ± 0.35	334 ± 11.9
Palgong-byeo	May. 25	Aug. 19	79 ± 1.47	352 ± 15.5	26.4 ± 1.10	77.9 ± 0.20	20.7 ± 0.47	308 ± 3.4
	Jun. 5	Aug. 29	77 ± 0.20	333 ± 6.9	25.6 ± 1.37	78.8 ± 1.90	20.5 ± 0.24	277 ± 3.4
LSD <sub>05</sub>								
C V %		-	2.60	82.65	4.68	4.20	1.38	34.40
C V %		-	1.59	11.22	8.76	2.54	3.30	5.45

Table . Variabilities of emergence ratio of direct-in-soil sown paddy rice affected by sowing depth

Cultivars	Sowing depth (cm)	Emergence (%) on days after sowing						Emergence ratio (%)	Seedling establishment ratio (%)
		1	2	3	4	5	6		
Saemgang-byeo	0	25	57	79	89	93	94	94 ± 2.0	79 ± 3.0
	1	1	2	39	76	93	96	96 ± 0.0	81 ± 1.0
	2	0	0	0	26	44	73	80 ± 0.0	75 ± 1.0
Gwanggye-onghyeo	3	0	0	0	0	24	63	71 ± 5.0	68 ± 4.0
	0	8	41	90	93	97	97	97 ± 1.0	81 ± 1.0
	1	4	41	65	92	93	93	93 ± 1.0	83 ± 1.0
Gwanggye-onghyeo	2	0	0	1	42	67	74	75 ± 3.0	72 ± 0.0
	3	0	0	0	1	15	43	50 ± 2.0	49 ± 1.0

Table . Changes in crop growth rate (CGR, g/m<sup>2</sup>/day) at different days after transplanting (DAT) or at different days after sowing (DAS) of rice grown under the different cultural patterns

Cultural patterns	Measured at							
	10 DAT 50 DAS	20 DAT 60 DAS	30 DAT 70 DAS	40 DAT 80 DAS	Heading stage			
Hand transplanted	0.73c	4.04b	19.30b	18.61a	10.38e			
	0.19f	1.92d	9.37cd	16.72ab	18.62b			
Machine transplanted	0.25d	3.09c	6.82e	15.70bc	10.28e			
	0.22e	2.45cd	10.81c	13.10d	15.14d			
Direct-sown	1.55a	6.25a	8.12de	18.40a	16.92c			
	1.17b	7.69a	27.63a	14.21cd	37.09a			

Table . Total energy embodied in input and output in rice cultivation under different cultural patterns of production systems in southern Korea in 1988

Cultural patterns	Input energy (MJ/ha)	Output energy (MJ/ha)	Energy efficiency
Hand transplanted	21,321(184)*	69,778	3.27(105.09)
Machine transplanted	27,070(135)	72,818	3.15(166.91)
Direct sown	26,274(365)	71,136	2.17(184.76)

\* Figures in parentheses are labour input cost and its energy ratio.

Table . Solar energy efficiency under different cultural patterns of rice production systems in southern Korea in 1988

Cultural patterns	Solar energy input (MJ/ha/year)	Output energy (MJ/ha)	Energy efficiency
Hand transplanted	36,367,000	69,778(5.65)*	0.0019
Machine transplanted	36,050,000	72,618(5.88)	0.0020
Direct sown	28,636,000	71,136(5.76)	0.0025

\* Figures in parentheses are grain yield of rice.