THE EFFECT OF HARVESTER TYPE (SELF PROPELLED, TRAILED OR FORAGE WAGON) AND STORAGE METHOD (BUNKER OR DRIVE OVER PILE) ON THE FORAGE DENSITY OF GRASS SILAGE ACROSS FINLAND

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INTRODUCTION

Density and pore spaces of ensiled forages have direct correlation to dry matter (DM) loss through fermentation and storage, by affecting the degree to which air can penetrate into and behind the face of the bunker or the drive over pile.

OBJECTIVE

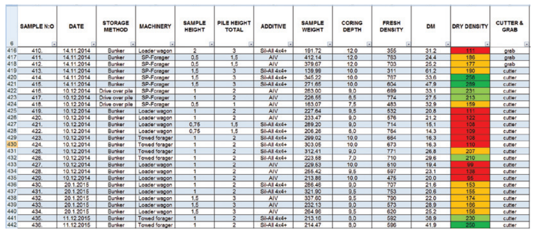
Determine the effect of harvester type and storage method on the forage density of grass silage in Finland

MATERIAL & METHODS

Forage : Primarily Timothy grass (mean DM 28.4% ± SD 8.3%)

Survey : 300 commercial farms across Finland

Measurements :
- Density of silage
- DM content of silage
- Height and type of silo
- Harvester type



6	SAMPLE N:O	DATE	STORAGE METHOD	MACHINERY	SAMPLE HEIGHT	PILE HEIGHT TOTAL	ADDITIVE	SAMPLE WEIGHT	CORING DEPTH	FRESH DENSITY	DM	DRY DENSITY	CUTTER & GRAB
416	410.	14.11.2014	Bunker	Loader wagon	2	3	Sil-All 4x4+	191,72	12,0	355	31,2	111	grab
417	411.	14.11.2014	Bunker	SP-Forager	0,5	1,5	AIV	412,14	12,0	763	24,4	186	grab
418	412.	14.11.2014	Bunker	SP-Forager	0,5	1,5	AIV	379,67	12,0	703	25,2	177	grab
419	413.	14.11.2014	Bunker	SP-Forager	1,5	3	Sil-All 4x4+	139,99	10,0	311	61,2	190	cutter
420	414.	14.11.2014	Bunker	SP-Forager	1,5	3	Sil-All 4x4+	345,22	10,0	787	33,6	258	cutter
421	415.	14.11.2014	Bunker	SP-Forager	1,5	3	Sil-All 4x4+	271,65	10,0	604	47,9	289	cutter
422	416.	10.12.2014	Drive over pile	SP-Forager	1	2	AIV	263,00	9,0	699	33,1	231	cutter
423	417.	10.12.2014	Drive over pile	SP-Forager	1	2	AIV	226,55	6,5	774	27,5	213	cutter
424	418.	10.12.2014	Drive over pile	SP-Forager	0,5	1	AIV	163,07	7,5	483	32,9	159	cutter
425	419.	10.12.2014	Bunker	Loader wagon	1	2	AIV	227,64	9,5	532	20,8	111	cutter
426	420.	10.12.2014	Bunker	Loader wagon	1	2	AIV	233,47	9,0	576	21,2	122	cutter
427	421.	10.12.2014	Bunker	Loader wagon	0,75	1,5	Sil-All 4x4+	289,20	9,0	714	15,1	108	cutter
428	422.	10.12.2014	Bunker	Loader wagon	0,75	1,5	Sil-All 4x4+	206,26	6,0	764	14,3	109	cutter
429	423.	10.12.2014	Bunker	Towed forager	1	2	Sil-All 4x4+	299,02	10,0	664	16,3	108	cutter
430	424.	10.12.2014	Bunker	Towed forager	1	2	Sil-All 4x4+	303,05	10,0	673	16,3	110	cutter
431	425.	10.12.2014	Bunker	Towed forager	1	2	Sil-All 4x4+	312,41	9,0	771	26,8	207	cutter
432	426.	10.12.2014	Bunker	Towed forager	1	2	Sil-All 4x4+	223,68	7,0	710	29,6	210	cutter
433	427.	10.12.2014	Bunker	Loader wagon	1	2	AIV	229,63	10,0	510	19,4	99	cutter
434	428.	10.12.2014	Bunker	Loader wagon	1	2	AIV	255,42	9,5	597	23,1	138	cutter
435	429.	10.12.2014	Bunker	Loader wagon	1	2	AIV	213,86	10,0	475	20,0	95	cutter
436	430.	20.1.2015	Bunker	Loader wagon	1	2	Sil-All 4x4+	286,46	9,0	707	21,6	153	cutter
437	431.	20.1.2015	Bunker	Loader wagon	1	2	Sil-All 4x4+	321,90	9,5	753	20,6	155	cutter
438	432.	20.1.2015	Bunker	Loader wagon	1,5	3	AIV	337,60	9,5	790	22,0	174	cutter
439	433.	20.1.2015	Bunker	Loader wagon	1,5	3	AIV	232,13	9,0	573	28,9	166	cutter
440	434.	20.1.2015	Bunker	Loader wagon	1,5	3	AIV	264,96	9,5	620	25,2	156	cutter
441	435.	11.12.2015	Bunker	Towed forager	1	2	Sil-All 4x4+	213,16	8,0	592	38,9	230	cutter
442	436.	11.12.2015	Bunker	Towed forager	1	2	Sil-All 4x4+	214,47	8,0	596	41,9	250	cutter

Figure 1. Example of data collected during survey

RESULTS & DISCUSSION

A. SILO TYPE

- Density of the grass silage in **walled silo**s was statistically significantly greater than that in the **drive over piles** (P<0.05) **(Table 1)**

Table 1. Description of storage system, method of harvesting and density analysis

Storage System	n	Harvesting System	n	Density Kg/m³ DM	Density Kg/m³ DM			
					Mean	SD	Min	Max
Walled Silos	323	Self Propelled	139	183.91 a b	193.7 a b	37.7	82.8	289.1
		Trailed Forager	74		184.3 a b	42.6	90.5	279.9
		Loader Wagon	110		168.9 b	31.8	95.0	250.0
Drive Over Pile	64	Self Propelled	29	161.52 b	162.8 b	34.8	103.0	231.3
		Trailed Forager	8		162.9	23.2	127.7	196.6
		Loader Wagon	27		148.5 b	37.1	79.4	211.3

a b *Means with a different suffix are statistically different at 95%.*
SD=standard deviation

B. HARVESTER TYPE

- **Self propelled forager** and **trailed forager** silos had significantly higher density than the silos produced with **loader wagon** harvested forage (P<0.05) **(Figure 1)**

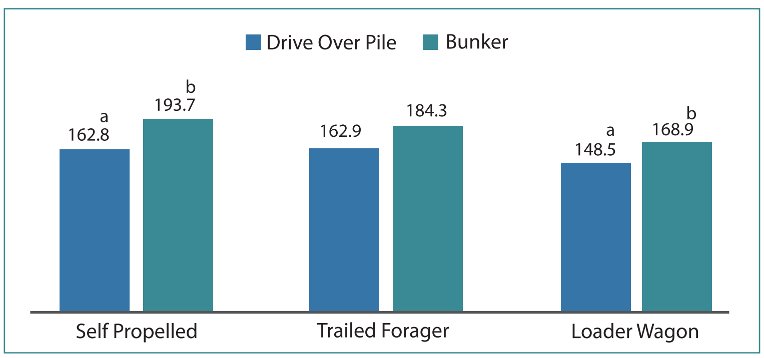


Figure 1. Comparative density of walled silos and drive over piles made with the same foraging equipment

a b *Means with a different suffix are statistically significantly different at 95%.*

CONCLUSION

This survey has shown that:

- **Walled silos are more efficient at protecting DM through storage than drive over piles due to the statistically higher density achieved (P<0.05).**
- **Grass silage produced with a loader wagon is expected to be subject to higher DM losses through storage and feed out than grass silage produced with a self propelled or trailed forager.**