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Nipple Drinkers for Brooding Commercial Large White Turkeys¹

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Abstract: The objective of this research was to determine the effect of using nipple drinkers during brooding on the performance of Large White turkeys. There were 6 different drinkers tested: the control and 5 nipple drinker systems. The control was the Plasson Drinker and the nipple systems tested were the Plasson Easy Start (PES), Val-Co Turkey Drinker (VC), Lubing Traditional Nipple (LTN), Lubing EasyLine™ (LEL) and Ziggity Big-Z Activator (BZ). Three experiments were conducted with turkeys brooded using the 6 drinker types. Some nipple drinker treatments were used in the rearing periods. At 20 wk, Body Weight (BW) was reduced for toms brooded to 6 wk on the LTN and brooded and reared on the VC. The use of LEL and LTN (during brooding) resulted in improved Feed Conversion (FC) at 20 wk. Trial 2-experiment 1 with hens of two strains was terminated at 3 wk because of excessive mortality from dehydration with some drinker types. In trial 2-experiment 2, there were no poult hydration issues. The BW of hens at 6 wk brooded on the Plasson Drinker and the VC were higher compared to the BW of hens brooded on the PES and the BZ with the BW of hens on the LEL being intermediate. The use of the LTN resulted in significantly lower hen BW compared with all other drinkers through 10 wk. By 16 wk, there were no longer differences in hen BW due to drinker type. Drinker type did not have an effect on hen FC. Nipple drinkers can be used effectively to brood turkeys with some types also being useful during the rearing period. However, poor quality, inactive, or diseased poults may be at risk for dehydration on some nipple drinker systems.

Key words: Nipple drinkers, turkey, brooding, body weight, feed conversion, litter

INTRODUCTION

Nipple drinkers for rearing broilers is now predominant offering the advantages of reduced labor, less water wastage and reduce processing plant condemnations (Goan, 1994; Lott *et al.*, 2001). However, the use of nipple drinkers in the turkey industry is more recent and has been restricted to the brooding period except for some trials with commercial hen and tom grow-out. Even during the brooding period, there are many questions about what is the best type of drinker and optimal age of transfer to grow-out (or to open drinkers). The objective of this research was to provide information concerning the use of nipple drinkers for brooding turkeys.

MATERIALS AND METHODS

All birds were raised and handled according to methods approved by the North Carolina State University Institutional Animal Care and Use Committee. A curtain-sided house containing 48 pens (6 m²/pen) with concrete floors covered with clean pine-shavings was used for all trials. Caked litter was removed as necessary and weighed. Clean shavings were added as needed. Four mixing fans placed in each of the two hallways served to mix natural air that was regulated by adjusting side-wall curtains. During brooding, supplemental gas-heaters in each hallway and heat

lamps in each pen were used to heat the house and pens. Lighting was continuous for the first 3 days and by natural daylight thereafter (except what light was provided by the heat lamps). House temperature was kept between 32.2°C and 34.5°C for the first 10 days and was then gradually decreased by 2.5°C each week to ambient temperature. High and low house temperatures were recorded twice daily in four locations throughout the house. Feed and water were provided *ad libitum*. Diets fed to all birds were typical of those commonly used in commercial turkey production and met or exceeded NRC nutrient recommendations (NRC, 1994). The control drinkers were the Plasson Drinker ("mini-bell" used during brooding to 6 wk) and the Plasson Adult Turkey Drinker during the grow-out period from 6 wk to market age (Diversified Imports, Maagan Micheal DN Mensashe, Israel). There were five nipple drinker systems compared to the control: Plasson Easy Start (Diversified Imports, Maagan Micheal DN Mensashe, Israel), Val-Co Turkey Drinker (VBT185, Val-Co, Lancaster, PA), Lubing Traditional nipple (FeatherSoft® high flow nipple with Littergard®, Lubing, Cleveland, TN), Lubing EasyLine™ (Lubing, Cleveland, TN) and Ziggity Big-Z Activator (Ziggity Systems, Inc., Middlebury, IN). All nipples were on 2 m sections with one section per pen. The Plasson Easy Start had four cups per 2 m. The ValCo Turkey Drinker and the Lubing EasyLine™ had

two cups per 2 m. The Lubing Traditional nipple had four nipples per 2 m. The Ziggity Big-Z Activator had five nipples per 2 m. Each drinker unit had a pressure regulator system on one end. The numbers of birds per drinker were much less than manufacturers' recommendations for commercial applications to insure adequate poult access to drinkers. All nipple drinkers were managed and operated according to each manufacturer's specifications especially with regard to water pressure and nipple height from the floor.

Trial 1-Toms: Eight hundred and sixty-four commercial Large White tom turkeys (Aviagen Turkeys, Lewisburg, WV) were reared to 20 wk. There were 18 day-of-hatch poult placed in each of 48 pens. A randomized block design was used with 6 drinker types and two supplemental water jug treatments (with and without until 3 d). The treatments were randomly assigned to 4 rows of 12 pens each. The rows served as experimental blocks in all trials to account for any effect of pen location within the house. Each of the drinker types was replicated 8 times and the jug treatment was replicated 24 times. All of the nipple drinkers remained in use to 6 wk to simulate commercial brooding duration. Beginning at 6 wk, nipple drinkers were changed to the Plasson Adult Turkey Drinker as the mean BW for each treatment fell significantly behind that of the controls. The Lubing Traditional was changed to the Plasson Adult Turkey Drinker at 6 wk. The Ziggity Big-Z Activator was changed to the Plasson Adult Turkey Drinker at 7 wk with the Plasson Easy Start being changed at 8 wk. The ValCo and Lubing EasyLine™ remained in use to 20 wk at the request of the manufacturers. The Lubing EasyLine™ brooder cup was changed to the grower cup at 6 wk. Body weight and feed consumption were measured at 3, 5, 6, 7, 8, 10, 12, 15 and 20 wk. Body weights were measured by pen at 1, 3 and 5 weeks of age and individually at all subsequent measurement dates. Period and cumulative Feed Conversion (FC) were calculated. Mortality and culled birds were removed as they occurred and their BW were used in calculating FC. Litter moisture (composite samples) was measured beneath the drinker at 6 and 20 wk.

Trial 2-Hens

Experiment 1: In this experiment, there were 1,440 Large White turkey hens were reared to 3 wk. A randomized block design was used with 6 drinker types and 2 hen strains (A and B). Thirty poult were placed in each of the 48 pens. The treatments were randomly assigned to pens in 4 rows of 12 pens each. No supplemental jug drinkers were used in this trial. Body weight and feed consumption were measured, by pen, at placement and 3 wk. This experiment was terminated at 3 wk because of excessive mortality. Hens of both strains were relatively inactive and were observed to

have poor success in obtaining water from several of the nipple drinker systems. Veterinary diagnostics on sampled poult revealed severe dehydration but no disease.

Experiment 2: In experiment 2, 1,440 commercial Large White turkey hens (Hybrid Turkeys, Kitchner, Ontario, Canada) were reared to 18 wk. There were 30 poult placed in each of the 48 pens. A 2 x 6 factorial randomized block design was used with 2 supplemental jugs treatments and 6 drinker types. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Acitvator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. In half the pens, a supplemental jug drinker was provided for the first week. A "brooding ball" provided by the manufacturer was added to the EasyLine™ cups during the first week. The purpose of the "brooding balls" was to raise the level of water in the cup making the water easier for the poult to find. The treatments were randomly assigned to pens in 4 rows of 12 pens each. The two jug treatments had 24 replications while each of the drinker treatments had 8 replications. Litter moisture was measured beneath the drinker in each pen at placement, 1-4 weeks and 6 wk. Body weight and feed consumption, by pen, were measured at 1, 3, 5, 6, 8, 10, 12, 14, 16 and 18 wk. Body weights were measured by pen at 1, 3 and 5 weeks of age and individually at all subsequent measurement dates. Period and cumulative FC were calculated. Mortality and culled birds were removed as they occurred and their BW was used in calculating FC. Litter cake was removed and weighed at 9, 12 and 18 wk.

All data were analyzed using the General Liner Models program of SAS, Inc. (SAS, 1992). All percentage data were subject arc-sin transformation before analysis. The effects of treatments and treatment interactions on performance parameters were determined. The LS Means procedure was used to separate treatment means ($p \leq 0.05$). The pen served as the experimental unit.

RESULTS

Trial 1-Toms: There were no differences in mortality between any treatment groups (data not shown). The mortality during brooding (0-6wk) was 2% while livability from 0-20 wk was 95%. There was no effect of supplemental drinker on turkey performance (data not shown). At 3 wk, the BW of the birds on the Lubing Traditional nipple and the Ziggity were less than the BW of the control birds (Table 1). At 6 wk, the BW of the birds on the Plasson Easy Start was less than the BW of the control birds. The BW of birds brooded on Lubing EasyLine™ and ValCo were intermediate. By 7 wk, birds

Table 1: Body weight of Large White commercial turkey males from placement to 20 wk of age brooded on different drinker types (Trial 1)¹

Age ²	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
0 ³	59	59	59	60	59	59	1
3 ⁴	0.716 ^a	0.703 ^{ab}	0.647 ^c	0.709 ^{ab}	0.700 ^{ab}	0.690 ^b	0.007
5	1.77 ^a	1.73 ^{ab}	1.49 ^c	1.75 ^{ab}	1.74 ^{ab}	1.71 ^b	0.02
6	2.50 ^a	2.37 ^b	2.04 ^c	2.44 ^{ab}	2.42 ^{ab}	2.37 ^b	0.04
7	3.45 ^a	3.28 ^b	2.94 ^c	3.34 ^b	3.32 ^b	3.28 ^b	0.04
8	4.43 ^a	4.24 ^b	3.85 ^c	4.26 ^b	4.24 ^b	4.21 ^b	0.05
10	7.09 ^a	6.80 ^b	6.25 ^c	6.87 ^b	6.74 ^b	6.78 ^b	0.07
12	9.74 ^a	9.42 ^a	8.95 ^b	9.48 ^a	8.97 ^b	9.45 ^a	0.12
15	13.76 ^a	13.64 ^a	13.04 ^b	13.82 ^a	13.33 ^{ab}	13.62 ^a	0.18
20	21.27 ^a	21.19 ^a	20.67 ^b	21.33 ^a	20.55 ^b	21.21 ^a	0.16

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Ziggity, Big-Z Acitvator at 7 wk and the Plasson Easy Start at 8 wk, Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ²Age 0 is day of hatch. Ages 3-20 are in wk. ³weight in g. ⁴weight in kg for wk 3-20. ^{a, b, c}Means within a row with different superscripts are significantly different (p<0.05)

Table 2: Cumulative feed consumption (kg/bird) of Large White commercial turkey males from placement to 20 wk of age brooded on different drinker types¹

Age(wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
3	1.08 ^a	1.04 ^{ab}	0.99 ^b	1.07 ^a	1.04 ^{ab}	1.04 ^{ab}	0.02
5	2.71 ^a	2.59 ^b	2.29 ^c	2.66 ^{ab}	2.62 ^{ab}	2.60 ^b	0.04
6	3.90 ^a	3.75 ^{ab}	3.24 ^c	3.84 ^{ab}	3.77 ^{ab}	3.74 ^b	0.06
7	5.34 ^a	5.22 ^a	4.58 ^b	5.27 ^a	5.22 ^a	5.18 ^a	0.07
8	7.39 ^a	6.97 ^b	6.18 ^c	7.06 ^b	6.94 ^b	6.84 ^b	0.09
10	11.24 ^a	10.66 ^b	9.59 ^c	10.89 ^{ab}	10.50 ^b	10.46 ^b	0.15
12	16.35 ^a	15.31 ^b	14.24 ^c	15.86 ^{ab}	15.22 ^b	15.40 ^b	0.28
15	26.75	25.65	24.34	25.62	25.57	25.72	0.50
20	51.77	50.77	49.44	50.41	48.93	52.49	0.99

¹Drinker Types: Plasson Bell and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional Nipple was changed at 6 wk, the Ziggity, Big-Z Acitvator at 7 wk, and the Plasson Easy Start at 8 wk, Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a, b, c}Means within a row with different superscripts are significantly different (p<0.05)

on all of the nipple drinkers had lower BW than control birds even though some of the drinkers had been switched over to the Plasson Adult Turkey Drinker. Significant differences in BW remained until 12 wk when some of the birds brooded on the nipple drinkers appeared to catch up to that of the control birds. This apparent compensatory growth for birds on some drinker treatments was associated to the drinkers being changed to the Plasson Adult Turkey Drinker. Changing the drinker gave the birds that had previously been on nipple drinkers access to open water. The Lubing EasyLine™ was changed from a brooding cup to a larger grower cup at 6 wk allowed greater access to water for birds on this drinker as well. At 15 wk, there was less difference in BW among the treatments and by 20 wk only birds brooded on the Lubing Traditional nipples and

brooded and reared on the ValCo Turkey Drinker were significantly less than all the other drinkers. By 20 wk, some of the birds had experienced some apparent compensatory growth compared to the controls birds with respect to body weight.

Feed consumption was reduced for the birds in treatments that experienced comparable reduced BW (Table 2). While water consumption was not measured, it is possible that birds brooded and reared on some drinker types experienced reduced water consumption, consumed less feed and therefore, grew less resulting in decreased BW compared to control birds.

The FC was significantly different by treatment only for 15-20 wk (Table 3). The birds brooded on the Lubing Traditional nipple had significantly improved FC but this might be attributed to their reduced BW. The birds

Table 3: Cumulative feed conversion of Large White commercial turkey males from placement to 20 wk brooded on different drinker types¹

Age(wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
3	1.50	1.48	1.53	1.51	1.48	1.51	0.02
5	1.53	1.50	1.54	1.52	1.50	1.52	0.02
6	1.56	1.55	1.58	1.57	1.56	1.57	0.02
7	1.56	1.59	1.56	1.58	1.57	1.59	0.02
8	1.67	1.64	1.60	1.66	1.64	1.62	0.02
10	2.00	2.00	1.97	2.02	1.99	1.98	0.03
12	2.00 ^a	1.95 ^{ab}	1.89 ^b	1.99 ^a	2.01 ^a	1.95 ^{ab}	0.03
15	2.17	2.11	2.08	2.08	2.11	2.13	0.04
20	2.62 ^a	2.55 ^{ab}	2.49 ^b	2.51 ^b	2.54 ^{ab}	2.63 ^a	0.04

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional Nipple was changed at 6 wk, the Ziggity, Big-Z Activator at 7 wk and the Plasson Easy Start at 8 wk, Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a, b}Means within a row with different superscripts are significantly different (p<0.05)

Table 4: Litter moisture¹ (%) beneath the drinker of Large White commercial turkey males from placement to market reared on different drinker types²

Age(wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
6	49.48 ^a	34.00 ^b	28.46 ^b	34.06 ^b	51.13 ^a	28.98 ^b	3.56
20	56.92 ^b			53.49 ^b	64.34 ^a		1.40

¹Litter moisture (%) was taken as a composite sample beneath the drinker. ²Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional Nipple was changed at 6 wk, the Ziggity, Big-Z Activator at 7 wk, and the Plasson Easy Start at 8 wk, Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a, b}Means within a row with different superscripts are significantly different (p<0.05)

Table 5: The effect of nipple drinker¹ type and strain on turkey hen poult mortality² at 3 wk (Trial 2-Experiment 1)

Strain	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple ²	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
A	9.2	23.4	8.3	34.1	11.7	24.9	5.1
B	5.0	5.8	1.7	17.5	3.3	5.0	4.1
Mean ¹	7.1 ^{bc}	14.6 ^b	5.0 ^c	25.8 ^a	7.5 ^{bc}	15.0 ^b	3.3

²Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. ¹Overall mean mortality by strain: Strain A = 18.6±1.8%, Strain B = 6.4±1.81% (p<0.05). ^{abc}Means with different superscripts are significantly different (p<0.05)

brooded and reared on the Lubing EasyLine™ also experienced improved FC while maintaining comparable BW to the controls. The birds reared on the Plasson Easy Start and the ValCo Turkey Drinker had FC intermediate to birds reared on the other drinkers. Litter moisture was measured at 6 and 20 wk (Table 4). This was a composite sample taken directly beneath the drinker. At 6 wk, all drinker types resulted in decreased litter moisture, except the ValCo Turkey Drinker, compared to the control. At 20 wk, litter moisture was measured for only those drinkers that remained throughout the entire trial: the Lubing EasyLine™, the

ValCo Turkey Drinker and the Plasson Drinker/Adult Turkey Drinker. Litter moisture beneath the drinkers was significantly greater for the ValCo Turkey Drinker compared to the Plasson Drinker. The Lubing EasyLine™ resulted in similar litter moisture to the control.

Trial 2-Hens

Experiment 1: Mortality by strain and drinker type for hens from placement to 3 wk was significant but without interaction (Table 5). Strain A experienced higher mortality than Strain B across all drinker types. By drinker

Table 6: Body weight of Large White commercial turkey hens brooded on different drinker types¹

Age (wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple ²	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
0 (g)	52	52	52	52	53	53	1
1 (g)	149	153	151	153	151	150	2
3 (kg)	0.572 ^a	0.578 ^a	0.545 ^b	0.579 ^a	0.572 ^a	0.582 ^a	0.005
5	1.47 ^a	1.48 ^a	1.32 ^b	1.46 ^a	1.48 ^a	1.46 ^a	0.01
6	2.04 ^a	1.99 ^b	1.75 ^c	2.02 ^{ab}	2.04 ^a	1.97 ^b	0.01
8	3.57 ^a	3.47 ^b	3.25 ^c	3.54 ^a	3.52 ^a	3.40 ^b	0.03
10	5.20 ^a	5.09 ^b	4.96 ^c	5.22 ^a	5.17 ^{ab}	4.98 ^c	0.03
12	6.45 ^a	6.28 ^b	6.26 ^b	6.45 ^a	6.39 ^a	6.15 ^c	0.04
14	7.89 ^a	7.78 ^a	7.87 ^a	7.85 ^a	7.88 ^a	7.57 ^b	0.05
16	9.02	8.90	8.96	9.02	8.89	8.82	0.05
18	10.14	9.95	10.05	10.04	10.03	9.95	0.07

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Activator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a, b, c}Means within a row with different superscripts are significantly different (p<0.05)

Table 7: Cumulative feed conversion of Large White commercial turkey hens 18 weeks of age brooded and reared on different drinker types¹

Age (wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
1	0.85	0.87	0.86	0.87	0.88	0.93	0.02
3	0.78	0.80	0.78	0.83	0.82	0.83	0.02
5	1.20	1.21	1.22	1.24	1.22	1.22	0.01
6	1.18	1.19	1.14	1.20	1.18	1.21	0.02
8	1.40 ^a	1.41 ^a	1.35 ^b	1.41 ^a	1.41 ^a	1.41 ^a	0.01
10	1.56	1.56	1.50	1.55	1.56	1.53	0.02
12	1.95	1.95	1.89	1.94	1.92	1.89	0.02
14	2.24	2.23	2.20	2.25	2.20	2.16	0.03
16	2.56 ^b	2.61 ^b	2.62 ^{ab}	2.71 ^a	2.62 ^{ab}	2.53 ^b	0.03
18	2.73	2.79	2.79	2.86	2.80	2.75	0.04

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Activator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a, b}Means within a row with different superscripts are significantly different (p<0.05)

type, higher mortality was observed in the birds brooded on the Lubing EasyLine™ drinkers compared to birds brooded on all other drinker types. This experiment was terminated at 3 wk.

Experiment 2: Mortality was not affected by treatment (data not shown). During the brooding period, mortality was 2% with 95% livability from 0-18 wk. No effect of supplemental drinkers on BW (152±1 g) was observed at 1 wk (data not shown). There were no differences in BW by drinker type at 1 wk (Table 6). At 3, 5, 6 and 8 wk, the BW of birds brooded on the Lubing Traditional Nipple was less than the BW of those birds brooded on the other systems even though the Lubing nipple drinkers were changed to the turkey bell at 6 wk. At 6 wk, the birds reared on the Plasson Easy Start and the

Ziggity had reduced BW compared to the birds grown on the Plasson Drinker and ValCo with birds on the Lubing EasyLine™ being intermediate.

At 14 wk, only the BW of the birds reared on the Ziggity were lower compared to the BW of the birds on the Plasson Drinker. At this point, these birds were switched from the Ziggity to the Plasson Adult Turkey Drinker because of the significant BW reduction. However, at 16 and 18 wk, there were no differences in BW due to drinker type. This lack of significant difference in BW due to drinker type appeared to be due to apparent compensatory gain rather than the small increase in BW variation (SEM).

Cumulative FC was not different by drinker type through the brooding period to 6 wk (Table 7). During the rearing period, cumulative FC was different at 8 wk with the birds

Table 8: Cumulative feed consumption (kg/bird) of Large White commercial turkey hens from placement to 18 wk brooded on different drinker types¹

Age(wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
1	0.127	0.134	0.131	0.133	0.134	0.139	0.004
3	0.316 ^{b,c}	0.328 ^b	0.297 ^c	0.345 ^a	0.337 ^a	0.346 ^a	0.010
5	1.75 ^a	1.78 ^a	1.61 ^b	1.81 ^a	1.80 ^a	1.78 ^a	0.020
6	2.39 ^a	2.37 ^a	2.00 ^b	2.42 ^a	2.41 ^a	2.37 ^a	0.034
8	5.01 ^a	4.89 ^{ab}	4.40 ^c	5.01 ^a	4.98 ^a	4.80 ^b	0.06
10	8.13 ^a	7.96 ^a	7.46 ^b	8.14 ^a	8.07 ^a	7.60 ^b	0.11
12	12.63 ^a	12.20 ^b	11.83 ^{b,c}	12.48 ^{ab}	12.26 ^{ab}	11.61 ^c	0.15
14	17.71 ^a	17.37 ^a	17.39 ^a	17.70 ^a	17.33 ^a	16.34 ^b	0.28
16	23.04 ^b	23.20 ^b	23.43 ^b	24.43 ^a	23.33 ^b	22.34 ^c	0.30
18	27.64	27.80	28.03	28.75	28.05	27.34	0.35

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Activator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{a,b,c}Means within a row with different superscripts are significantly different (p<0.05)

Table 9: Litter moisture (%) beneath different drinkers¹ used for brooding Large White commercial turkey hens from placement to 6 wk

Age (wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
1	16.03	19.52	8.08	24.38	25.00	8.55	6.61
2	22.14 ^a	21.11 ^{ab}	15.35 ^b	17.14 ^{ab}	13.32 ^b	15.70 ^b	1.97
3	35.71 ^a	24.50 ^b	25.68 ^b	25.23 ^b	21.84 ^b	22.73 ^b	2.18
4	60.92 ^a	58.70 ^a	41.92 ^b	53.29 ^{ab}	61.69 ^a	40.24 ^b	4.94
6	49.81 ^b	65.63 ^a	47.99 ^b	54.60 ^{ab}	50.41 ^b	44.64 ^b	4.03

¹Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Activator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{ab,c}Means within a row with different superscripts are significantly different (p<0.05)

reared on the Lubing Traditional nipple having improved FC compared to all other drinker types. There were no significant differences in cumulative FC from 10-14 wk. At 16 wk, the birds on the Lubing EasyLine™ had a higher FC compared to those reared on the Plasson Drinker, Plasson Easy Start and the Ziggity, with those reared on the Lubing Traditional nipple and ValCo Turkey Drinker being intermediate. There were no significant differences in cumulative FC by drinker type at 18 wk.

Cumulative feed consumption followed trends similar to those observed for BW (Table 8). At 6 wk, only the birds reared on the Lubing Traditional nipple had reduced feed consumption compared to those brooded on the Plasson Drinker. The birds brooded with the Lubing Traditional nipple, Plasson Easy Start, ValCo Turkey drinker and the Ziggity had reduced feed consumption at various weeks during the rearing period from 8-16 wk. However, by 18 wk cumulative feed consumption was not different drinker type.

Litter moisture collected from throughout the pens

increased during the brooding period but was not different by drinker type through 6 wk (not shown). Litter moisture immediately beneath the drinker was not different at 1 wk (Table 9). At 2 wk, litter moisture beneath the drinker was lower in pens with the Lubing Traditional nipples, ValCo Turkey Drinkers and the Ziggity drinkers compared to pens with the Plasson Drinker and the Lubing EasyLine™ with the pens with Plasson Easy Start being intermediate. All nipple drinker systems had lower litter moisture beneath the drinker at 3 wk compared to the Plasson Bell. By 4 wk, only the pens with the Lubing Traditional nipple and the Ziggity had lower litter moisture beneath the drinker compared to the control pens with the Lubing EasyLine™ pens being intermediate. At the end of the brooding period, the pens with the Plasson Easy Start drinkers had higher percent litter moisture beneath the drinker compared to pens with all other drinkers except for the pens with the Lubing EasyLine™ being intermediate. The high litter moisture in the Easy Start pens was mostly due to the hens roosting or attempting to roost on the waterer units

Table 10: Litter cake (kg)¹ removed from pens of large white commercial turkey hens from 9-18 wk brooded on different drinker types²

Age (wk)	Plasson Bell	Plasson Easy Start	Lubing Traditional Nipple	Lubing Easy Line™	ValCo Turkey Drinker	Ziggity, Big-Z Activator	SEM
9	27.75	22.65	26.85	36.82	29.98	3.30	10.10
12	65.04 ^a	64.32 ^a	17.79 ^b	63.98 ^a	40.23 ^{ab}	6.93 ^b	13.66
18	41.88	78.18	50.85	35.41	36.81	31.54	10.81
Total ¹	153.98 ^a	176.51 ^a	103.21 ^b	145.85 ^{ab}	141.50 ^{ab}	41.75 ^c	17.83

¹Total litter cake is the sum of all cake removed throughout the course of the trial. ²Drinker Types: Plasson Drinker and Plasson Easy Start (Diversified Imports, MaaganMicheal DN Mensashe, Israel, 37805), Lubing Traditional Nipple and Lubing EasyLine™ (Lubing, Cleveland, TN 37311), Ziggity, Big-Z Activator (Ziggity, Watering Systems, Inc., Middlebury, Indiana, 46540) and ValCo Turkey Drinker (VBT185, Val-Co, Lancaster, Pennsylvania, 17603). Lubing Traditional Nipple is the FeatherSoft® high flow nipple with Littergard®. Nipple drinkers were changed to the Plasson Adult Turkey Drinker as follows: Lubing Traditional nipple was changed at 6 wk, the Plasson Easy Start at 12 wk the Ziggity, Big-Z Activator at 14 wk and the Lubing EasyLine™ and the ValCo Turkey Drinker were not changed. ^{abc}Means within a row with different superscripts are significantly different (p<0.05)

and therefore, spilling water from the cups and onto the litter floor. With a proper “shocker wire” this should not be an issue in commercial flocks.

Litter cake in pens was not different by drinker type at 9 wk (Table 10). From 9-12 wk, pens with the Lubing Traditional nipple and Ziggity drinkers had less litter cake than did the pens with Plasson Drinker, Plasson Easy Start, or Lubing EasyLine™ with the ValCo Turkey Drinker pens being intermediate. There were no differences in litter cake by drinker type for the 12-18 wk period. Cumulatively, the Plasson Drinker and Plasson Easy Start pens had the most litter cake followed the pens with the Lubing EasyLine™, ValCo Turkey Drinkers, and the Lubing Traditional nipples. The pens with birds brooded and reared to 14 wk with the Ziggity drinkers had the least amount of litter cake at 18 wk.

DISCUSSION

While now commonly reared on nipple drinkers, broilers can experience difficulty consuming optimal amounts of water especially during times of high temperature (Goan, 1994; May *et al.*, 1997; Wabeck *et al.*, 1994). Under such conditions, it is not uncommon for the use of nipple drinkers to result in reduced broiler BW gain. The Lubing Traditional nipples used in the current study are representative of those used in broiler production. Nipple water flow rate is a factor in broiler water consumption and therefore, rate of broiler BW gain. This becomes more critical as environmental temperature and target broiler BW increase (Goan, 1994; May *et al.*, 1997). While the Lubing Traditional nipple was managed according to the manufacturer's recommendation, performance of poult on the Lubing nipple in this study may have been improved if nipple water flow rate had been increased. However, it should be noted that even in open water systems such as the Plasson Easy Start where flow rate was not an issue, turkey poult performance was reduced. Hulet (1999) reported that nipple drinkers were effective in brooding conditions or up to 10 wk. However, Hulet (1999) also reported reduced turkey BW with comparable or improved FC by market age. Similarly, in a field trial by

Rives (2001), BW seem to be reduced at 5-6 wk, but stabilized by 10-12 wk when put back on the Plasson Adult Turkey Drinker for the grow-out phase. In the current study, like the Rives (2001) field trial, birds experienced compensatory growth when nipple drinkers were replaced by the Plasson Adult Turkey Drinker. In broilers, compensatory gain has been observed for birds held off of feed and/or water for 12 h (Chamblee *et al.*, 1989). Both in this study and in the Rives (2001) field trial, it was concluded that a combination of the two drinker types may be optimal in certain instances. For example: in this study, birds which were brooded on the Plasson Easy Start and Ziggity and then switched to the Plasson Adult Drinker performed as well as the control birds. However, some new systems seem to work well for the entire life of the flock. For example, birds on the Lubing EasyLine™, which remained throughout the study, exhibited comparable performance to birds on the conventional Plasson Adult Turkey Drinker.

In general, turkeys brooded on nipple drinkers experienced decreased BW and improved FC. However, as noted by Hulet (1999) for rearing turkeys and by Goan (1994) for rearing broilers, the advantages of nipple drinkers can offset the disadvantage of reduced BW. On a performance basis, even though BW may be reduced, FC can be improved and overall bird health may be improved if the system is managed so that birds have access to clean, less contaminated drinking water. However, water provided to birds in closed systems is not necessarily of better quality than that of open water systems over an extended period of time (Watkins, 2002). However, over a short period of time and with a new system such as in this study, birds may have experienced cleaner water in adequate supply such as for the Lubing EasyLine™ in Trial 1 resulting in improved performance compared to the controls. Since nipple drinkers are a closed system, they can be managed to maintain drier litter which also contributes to improved growing conditions. In many cases, the BW lost during the brooding period might be regained during the rearing period depending on the drinker system. Practically, nipple systems provide turkey growers with

a labor saving alternative to traditional open-water systems. Nipple drinkers need less cleaning and maintenance and allow for easier administration and less wasting of vaccinations and medications. As observed in this study, some systems, whether they be new or improved, may result in comparable growth rates, improved litter quality and reduced grower labor depending, in some cases, on how they are used and managed.

Conclusion: In conclusion, nipple drinker systems designed for turkeys can be used for brooding turkeys to 6 wk. While some BW reduction may be observed, compensatory gain may be experienced once birds are placed on open water systems that provide greater access to drinking water. Some turkey nipple drinker systems may be adequate for rearing birds to market depending on their design, length of use and management. Poor quality, inactive, or diseased poults with low activity may be at risk for dehydration when brooded on some nipple systems.

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REFERENCES

- Chamblee, T.N., G.W. Morgan and C.D. Schultz, 1989. Effect of refeeding following short-term deprivation of feed or water, or both, on selected physiological parameters for broiler chickens. *Poult. Sci.*, 68: 1619-1623.
- Goan Charles, H., 1994. Management of nipple watering systems for broilers. The University of Tennessee Agriculture Extension Service. PB 1533. <http://www.utextension.utk.edu/publications/pbfiles/pb1533.pdf> Accessed May 2009.
- Hulet, R.M., 1999. Use of nipple drinkers for turkey production. Pages 50-58 in Proceedings of the Twenty-Third Annual North Carolina Turkey Industry Days Conference. North Carolina State University, Raleigh, NC.
- Lott, B.D., J.D. May, J.D. Simmons and S.L. Branton, 2001. The effect of nipple height on broiler performance. *Poult. Sci.*, 80: 408-410.
- May, J.D., B.D. Lott and J.D. Simmons, 1997. Water consumption by broilers in high cyclic temperatures: Bell verses Nipple waterers. *Poult. Sci.*, 76: 944-947.
- National Research Council, 1994. Nutrient Requirements of poultry. 9th Rev. Ed. National Academy Press, Washington, DC.
- Rives David, 2001. Prestage Farms, Inc., Clinton, NC. Personal communication.
- SAS Institute, Inc, 1992. SAS Institute, Cary, NC.
- Wabeck Charles, J., E. Lewis Carr and Veronica Byrd, 1994. Broiler drinker systems and seasonal effects on eviscerated carcass and leaf fat weights. *J. Appl. Poult. Res.*, 3: 274-278.
- Watkins Susan, 2002. The campaign for quality drinking water continues. *Avian Advice*, 4: 7-9. http://www.uark.edu/depts/posc/pdfs/avian_advice_4.3.pdf Accessed May 2009.

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