parazitarnye bolezni: Spravochnik [Tekst] / B.I. Antonov, V.V. Borisova, L.P. Kameneva, L.I. Kovalerchuk, G.A. Mihal'skij, V.D. Pevneva, L.I. Pryanishnikova. - M.: Agropromizdat, 1987. - 240 s.

13 GOST 31766-2022 Medy monoflornye. Tekhnicheskie usloviya [Tekst]. - Vzamen GOST 31766-2012; vved. 2023-01-01. - M.: Rossijskij institut standartizacii, 2022. - 6 s.

14 GOST 19792-2017 Med natural'nyj. Tekhnicheskie usloviya [Tekst]. - Vved. 2019-01-01. - M.: Standartinform, 2017. - 12 s.

15 GOST 31774-2012 Med. Refraktometricheskij metod opredeleniya vody [Tekst]. - Vved. 2013-07-01. - M.: Standartinform, 2018. - 7 s.

16 GOST 32167-2013 Med. Metod opredeleniya saharov [Tekst]. - Vved. 2014-01-01. - M.: Standartinform, 2018. - 12 s.

17 GOST 34232-2017 Med. Metody opredeleniya aktivnosti saharazy, diastaznogo chisla, nerastvorimyh veshchestv [Tekst]. - Vved. 2019-01-01. - M.: Standartinform, 2017. - 19 s.

18 GOST 31768-2012 Med natural'nyj. Metody opredeleniya gidrooksimetilfurfuralya [Tekst]. - Vved. 2013-07-01. - M.: Standartinform, 2019. - 14 s.

19 GOST 32169-2013 Med. Metod opredeleniya vodorodnogo pokazatelya i svobodnoj kislotnosti [Tekst]. - Vved. 2014-01-01. - M.: Standartinform, 2019. - 8 s.

20 GOST 31770-2012 Med. Metod opredeleniya elektroprovodnosti [Tekst]. - Vved. 2013-07-01. - M.: Standartinform, 2019. - 8 s.

21 Marapov, D. Medicinskaya statistika. - [Elektronnyj resurs].- Rezhim dostupa: https://medstatistic.ru.

РЕЗЮМЕ

Дана ветеринарно-санитарная оценка качества двенадцати образцов свежеоткаченного меда, собранного в разных районах Восточного Казахстана на четырех пасеках (3 неблагополучных по нозематозу и 1 условно-здоровая) от разных по силе пчелиных семей. Изучены органолептические (цвет, аромат, вкус, консистенция (внешний вид), наличие признаков брожения) и основные физико-химические показатели качества меда (массовая доля воды, массовая доля редуцирующих сахаров и сахарозы, содержание диастазного числа, присутствие гидрооксиметилфурфураля и механических примесей). Дополнительно определены свободная кислотность, электропроводность, массовая доля нерастворимых веществ и водородный показатель. Все показатели изученных образцов соответствовали национальным и межгосударственным стандартам качества меда. При этом существенной разницы в качественных и количественных показателях свежеоткаченного меда, отобранного на неблагополучных пасеках по болезням и условно-здоровой пасеке, установлено не было ($p>0,05$). Лишь в отдельных случаях разница показателей приближена к минимальному порогу достоверности. В разных по силе пчелиных семьях количественные показатели меда также отличаются, однако, данные различия статистически не значимы, так как достоверность разницы полученных результатов не превышает допустимый уровень значимости ($p>0,05$).

UDC 619:636.2.082.453:621.316.729 ***DOI 10.52578/2305-9397-2023-3-1-158-166***
IRSTI 68.41.49

Jumatayeva K.K., Ph.D. doctoral student, **the main author**, https://orcid.org/0000-0002-8548-9786
NJSC «Kazakh national agrarian research university», Almaty, Abaya Avenue., 8, 050010, Kazakhstan, turlybekova.kumis@mail.ru
Julanov M. N., Doctor of Veterinary Sciences, Professor, https://orcid.org/0000-0003-4471-3910
NJSC «Kazakh national agrarian research university», Almaty, Abaya Avenue., 8, 050010, Kazakhstan, mardan__58@mail.ru
Koibagarov K. U., Candidate of Veterinary Sciences, Associate Professor, https://orcid.org/0000-0002-5639-1798
NJSC «Kazakh national agrarian research university», Almaty, Abaya Avenue., 8, 050010, Kazakhstan, kanat_ukan@mail.ru
Julanova N. M., PhD, https://orcid.org/0000-0001-9850-0983

NJSC «Kazakh national agrarian research university», Almaty, Abaya Avenue., 8, 050010, Kazakhstan, nuramirayat@mail.ru
Aidarbekov S.D., Master of Veterinary Sciences, https://orcid.org/0000-0001-5697-5075
NJSC «Kazakh national agrarian research university», Almaty, Abaya Avenue., 8, 050010, Kazakhstan, sultanaidarbekov16@gmail.com
Kuserbayeva A.T., PhD, Associate Professor, https://orcid.org/0000-0003-4748-9037
NJSC «M.Auezov South Kazakhstan University», Shymkent, Tauke Khan Avenue 5, Kazakhstan, aisulu_171287@mail.ru
Bayzhanov K. S., candidate of Agricultural Sciences, https://orcid.org/0000-0002-4229-8843
NJSC «M.Auezov South Kazakhstan University», Shymkent, Tauke Khan Avenue 5, Kazakhstan,

THE INFLUENCE OF SOME CLIMATIC FACTORS ON THE EFFECTIVENESS OF ESTRUS SYNCHRONIZATION IN BEEF OF DAIRY COWS

ANNOTATION

The aim of this study was to determine the influence of the temperature humidity index (THI) on the efficiency of estrus synchronization on both beef and dairy cows. The research was carried out at APC "Azamat" of the Beskaragai district of the East Kazakhstan region of the Republic of Kazakhstan. The natural and climatic conditions of this zone make it possible to raise both beef and dairy cattle. The study involved 408 Kazakh white-headed cows aged 3 to 5 year.

During the experimental period, the data for air temperature (T), relative humidity (φ), wind speed (υ) were collected, and the temperature humidity index (THI) was determined. The data was recorded for 30 days (10 days before synchronization, 10 days during synchronization and 10 days after synchronization). In addition, during the synchronization period, clinical parameters - body temperature (t), pulse (P), respiratory rate (Re) and rumination (R) were measured daily in 10% of animals by conventional methods.

During the experimental period (2020-2022) THI was 74,50±1,31, 78,20±2,11, 72,80±0,7210 days before the estrus synchronization. When THI was increased by 5.6±0.03 in 2021 compared to 2020, the fertility decreased by 9.7±0.78. Similarly, when THI was increased by 7.3 ± 0.56 compared to 2022, fertility was reduced by 13.8 ± 0.36. The latter indicates that when THI increases the fertility rate decreases.

Based on the results, there is an influence of THI on the effectiveness of estrus synchronization. Increased THI, to a certain extent, reduces both estrus expression and effectiveness of estrus synchronization leading to reduced fertility rate and increased embryonic mortality.

Key words: Estrus synchronization; cows, artificial insemination; temperature humidity index.

Introduction. Republic of Kazakhstan has priority focus for developing of the cattle breeding by implementation of several state agriculture programs ("Sybaga" and "Yrys") that are aimed to increase the number of beef and dairy cattle.

One method of intensification of reproduction in cattle breeding is the estrus synchronization to obtain a yearly calving. Nevertheless, there are no information in the literature regarding the influence of temperature, relative humidity, temperature-humidity index (THI) and wind speed on the efficiency of the estrus synchronization in cows. On the other hand, there are some information that link the fertility rate and the season of the year in cows' [1, 2, 3]. According to some authors, one of the reason for the low fertility rate in cows during summer is the increased ambient temperature that causes heat stress. The problem of heat stress is a limiting factor of effective fertilization and productivity [4, 5].

Heat stress affects the function of the corpus luteum, the growth and maturation of the follicles, estrus behavior, superovulation, the embryo quality and fertility [6]. During the heat stress the proportion of pregnant cows' decreases that might be due to the deterioration of the quality of the oocytes. In addition, an increased ambient temperature causes a delayed ovulation, degenerative changes in germ cells, and embryonic death [7, 8].

The negative effect of the heat stress could be observed in June, with maximum effects in July-August and a slow increase in the next 2 months [9].

According to a number of authors, spermatogenesis is also negatively affected by increased ambient temperature. Thus, an increase in temperature in the scrotum significantly worsens the morphological and functional qualities of the sperm. However, it should be noted that the heat has a less serious impact on the quality of the bull semen of aboriginal breeds [10, 11].

Since there is a lack of information regarding the effects of environmental factors on the efficiency of the estrus synchronization in cows during summer, we aimed to determine the influence of the temperature humidity index (THI) on the efficiency of estrus synchronization in cows during summer.

Materials and methods of research. The research was carried out during 2020 - 2022 on 408 Kazakh white-headed cows. These animals were kept at APC "Azamat" Beskaragai district of East Kazakhstan region.

Animals during the spring, summer and autumn were free to pasture with natural watering. The pasture was rich herbage. During the winter, the diet consisted of pasture hay, salt, chalk, and water was offered ab libitum.

During the experimental period, the air temperature (T), relative humidity (φ), wind speed (υ) were collected, and the temperature humidity index (THI) was determined. The data was recorded for 30 days (10 days before, 10 days during and 10 days after synchronization). During the synchronization period, clinical parameters - body temperature (t), pulse (P), respiratory rate (Re) and rumination (R) were measured daily in 10% of animals by conventional methods.

The air temperature and ambient humidity were determined by a psychrometric hygrometer VIT-2 (Private Joint Stock Company "STEKLOPRIBOR", Ukraine). In addition, a portable combine harvester was used – a multifunctional environmental parameter meter MASTECH MS6300 (China). This device was used to determine the air temperature, relative humidity and wind speed.

Synchronized animals were selected according to the results of gynecological examination. Gynecological examination was done using ultrasound device "Mindray" Z5, (China). Estrus was synchronized using an Ovsynch protocol consisting of two injections of GnRH (Fertagyl, MSDAnimal Health, Netherlands)) on day 0 and day 9 and prostaglandin (Prosolvin, MSDAnimal Health, Netherlands) on day 7. Timed artificial insemination (TAI) was done at 16 h and 24 h after the second injection of GnRH (Figure 1).

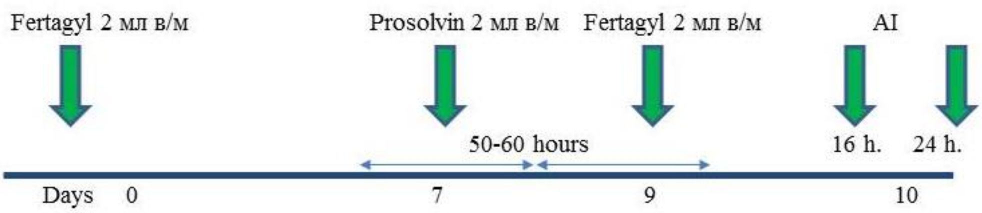

Figure 1 - Estrus synchronization. Estrus was synchronized using Ovsynch protocol consisting of two injections of GnRH on day 0 and day 9 and prostaglandin (on day 7. Timed artificial insemination (TAI) was done at 16 h and 24 h after the second injection of GnRH.

Pregnancy diagnosis was carried out on day 30 after insemination using ultrasound device "Mindray" Z5, (China) with 6,5MHz rectal linear probe. Confirmation of pregnancy was done at day 60 after insemination. Cows that have been diagnosed pregnant at day 30 but not pregnant at day 60 was consider to have an embryonic mortality.

Results. During 2020, ten days before the start of the estrus synchronization, the ambient temperature averaged 27.6 ± 0.95°C while, the air humidity was 41.9 ±1.58%, and the wind speed was within 4.1 ±0.69 m/s. Our observations (Table 1) have showed that THI, 10 days before the start of the synchronization averaged 74.5±1.31. At the same time, within the threshold level of heat stress were day 2, 3 and 6, while days-1, 4, 7, 8, 10 were within the minimum heat stress and 1 day – average heat stress (day 9).

During the night, the effects of minimal heat stress on animals were on days 1, 4, 5, 9. In addition, the THI averaged 71 and 76.

During the estrus synchronization, the ambient temperature averaged 25.6 ± 0.63°C, air humidity - 47.4 ± 1.43%, whilst the wind speed was within 4.4 ± 0.55 m/s. THI averaged 72.4±0.77. The animals were within the threshold of heat stress on day 1 and 3, (70). The remaining 8 days (2, 4, 5, 6, 7, 8, 9, 10 days) were the days of minimal heat stress (71-78) based on the THI indicators. At the same time, THI adversely affected animals to a certain extent during the night (66-70) whereas minimal heat stress was created on days 1, 9, 10 (71-74) (Table 1).

Upon completion of synchronization for 10 days, the ambient temperature averaged 25.1 ± 0.67°C, air humidity - 43.1 ± 1.43%, whereas the wind speed was within 3.5 ± 0.61 m/s. Simultaneously , the THI averaged 71.3±0.98. On days 1, 7, 9, 10, THI was within the threshold of heat stress (67-70), while at days 2, 3, 4, 5, 6, 8 minimal heat stress was observed (72-76). In addition, the nighttime had a beneficial effect on the animals, while THI corresponded to the threshold of heat stress. Only the night of the 1st and 5th days corresponded to minimal heat stress (71-73) (Table 1).

As mentioned above, in the first series of the experiment (2020) there were 103 cows, of which 11 animals on the days of synchronization were clinically examined to measure the body temperature - T, pulse - P, respiratory rate – Re and rumination - R. Body temperature during the synchronization period was within the physiological range and averaged 37.4± 0.18°C. At the same time, the respiratory rate and pulse were slightly increased - 65.4±3.05/min. and 86.4±0.48/min respectively, while the rumination was decreased - 2.0±0.24 /2 min. The latter to a certain extent confirmed the negative impact of THI on the cows' health.

At day 30, 92.2±2.72% were diagnosed pregnant while at day 60, 84.5 ± 3.68% were confirmed pregnant. The latter indicated that 7.8% of cows underwent early embryonic mortality.

Table 1 – Dynamics of temperature, humidity, THI and wind speed during the synchronization period 2020 year (Table 2).

Days	t		Afternoon				
	F°	C°	35	40	45	50	55
1	82,4	28	74	74	75	76	76
2	77	25	70	71	71	72	72
3	77	25	70	71	71	72	72
4	84,2	29	75	76	76	77	78
5	86	30	76	77	78	78	79
6	71,6	22	67	67	67	68	68
7	80,6	27	73	73	74	74	75
8	84,2	29	75	76	76	77	78
9	87,8	31	77	78	79	80	80
10	86	30	76	77	78	78	79
11	73,4	23	68	68	69	69	70
12	77	25	70	71	71	72	72
13	75,2	24	69	70	70	70	71
14	80,6	27	73	73	74	74	75
15	77	25	70	71	71	72	72
16	78,8	26	71	72	73	73	74
17	78,8	26	71	72	73	73	74
18	77	25	70	71	71	72	72
19	77	25	70	71	71	72	72
20	86	30	76	77	78	78	79
21	73,4	23	68	68	69	69	70
22	78,8	26	71	72	73	73	74
23	80,6	27	73	73	74	74	75
24	77	25	70	71	71	72	72
25	82,4	28	74	74	75	76	76
26	78,8	26	71	72	73	73	74
27	71,6	22	67	67	67	68	68
28	80,6	27	73	73	74	74	75
29	75,2	24	69	70	70	70	71
30	73,4	23	68	68	69	69	70

Days	t		Night				
	F°	C°	35	40	45	50	55
1	80,6	25	70	71	71	72	72
2	84,2	23	68	69	69	70	70
3	86	23	68	69	69	70	70
4	60,8	25	71	71	72	72	72
5	64,4	28	74	75	76	76	76
6	71,6	20	65	65	65	66	66
7	68	22	67	67	68	68	68
8	73,4	23	68	69	69	70	70
9	82,4	28	74	75	76	76	76
10	73,4	27	73	74	74	75	75
11	68	20	65	65	65	66	66
12	77	23	68	69	69	70	70
13	69,8	21	66	66	67	67	67
14	73,4	23	68	69	69	70	70
15	69,8	21	66	66	67	67	67
16	73,4	23	68	69	69	70	70
17	71,6	22	67	67	68	68	68
18	69,8	21	66	66	67	67	67
19	75,2	24	70	70	70	71	71
20	78,8	26	72	73	73	74	74
21	78,8	26	72	73	73	74	74
22	69,8	21	66	66	67	67	67
23	69,8	21	66	66	67	67	67
24	66,2	19	63	64	64	64	64
25	75,2	24	70	70	70	71	71
26	71,6	22	67	67	68	68	68
27	68	20	65	65	65	66	66
28	73,4	23	68	69	69	70	70
29	71,6	22	67	67	68	68	68
30	71,6	22	67	67	68	68	68

Note: Temperature in Fahrenheit (F), Celsius (°C).

Table 2 – Pregnancy rate and embryonic mortality

Years	Total	Pregnancy 30 days		Pregnancy 60 days		Embryonic mortality	
		n	%	n	%	n	%
2020	103	95	92,2±2,72	87	84,5±3,68	8	7,8
2021	139	115	82,7±4,46	104	74,8±4,46	11	7,9
2022	166	157	94,6±2,92	147	88,6±4,10	10	6,0

During 2021, 10 days before the start of the synchronization, the ambient temperature was on average 30.9 ± 0.95°C, and at night 24.7 ± 1.10°C. At the same time, the air humidity was 52.7 ±1.23%, and the wind speed was within 2.9±0.58 m/s. THI averaged 80.1±1.28 during the day and 71.6±1.47 during the night. Minimal heat stress was observed at a THI of 74-78. At days 1, 6, 7, 8, 9. The average heat stress was observed on days 2, 3, 4, 5 and 10 with a THI of 80-87 (Table 3).

During the estrus synchronization, the ambient temperature averaged 31.2 ± 0.60°C. At the same time, the air humidity was 50.0 ±1.61%, and the wind speed was within 3.5±0.69 m/s. THI averaged 80.1±1.28.In addition, the first 2 days based on the temperature and humidity index, (4-7, 8, and 10, were the days of average heat stress (80-84). Minimal heat stress was observed at THI of 77-79 at days 3, 5, 6 and 9 (Table 3).

Upon completion of the estrus synchronization, the ambient temperature during the day and night averaged 27.2 ± 1.04°C, and 24.2 ± 0.52°C respectively., The air humidity was 48.5 ±1.83%, and the wind speed was within 3.5±0.45 m/s. THI averaged 74.3±1.16. The first 5 days and days 7, 8 and 10 were within the limits of minimal heat stress, whilst the average heat stress was observed on day 6 (80). Minimal heat stress was observed at the THI on day 9 (70) (Table 3).

At day 30 days 82.2±4.46% of the cows were diagnosed pregnant while on day 60, 74.8 ± 4.46% of the cows were confirmed pregnant indicating that 7.9% of cows underwent early embryonic mortality. We are speculating that the reason for the low fertility rate during this period might be the effect of THI either on the oocytes quality or on the uterus both during the day and at night (Table 2).

In 2021, the data from14 cows out of 139 were collected for the clinical indicators (T, P, Re, R). During the synchronization period, the body temperature was within the physiological range and averaged 39.9 ± 0.14°C. Respiratory rate and pulse were increased - 78.2±0.42/min. and 98.9±0.96/min respectively while the rumination was decreased – (1.5±0.19 /2 min).

In 2022, 166 cows were examined. Ten days before the start of the estrus synchronization, the ambient temperature averaged 26.6 ± 0.53°C. At the sae time, the air humidity was 42.0 ±1.25%, and the wind speed was within 3.7±0.47 m/s. THI for 10 days before synchronization averaged 72.8±0.72. The permissible threshold of heat stress was observed for 3 consecutive days at a temperature and humidity index of 70 (4, 5, 6 days). Minimal heat stress was observed at THI 71-76, on day 1, 2, 3 and the last 4 days in a row (7, 8, 9 and 10 days) (Table 4).

During the synchronization, the ambient temperature averaged 24.0 ± 1.47°C. At the same time, the air humidity was 39.5 ±1.16%, and the wind speed was within 3.9±0.69 m/s. THI averaged 69.5±1.77. In addition, the threshold of heat stress was observed (THI 64-70) on the second day and at the last 5 consecutive days (5, 6, 7, 8, 9, 10). On contrary, minimal heat stress was observed at 1, 3, 4 days when the THI was 76-78 (Table 4).

Ten days after the synchronization, the ambient temperature averaged 24.0±1.54°C. At the same time, the air humidity was 43.7 ± 1.29%, and the wind speed was in the range of 3.7 ± 0.42 m/s. THI averaged 70.0±1.97. During the days 2, 3, 4, 6, 7, 8, 9 there was acceptable heat-stress threshold. Minimal heat stress was observed at THI of 72-77 (days 5 and 10).

In 2022, the data from 14 cows out of 166 were clinically examined. During the protocol the body temperature was in the physiological range and averaged 38.5 ± 0.11°C. Respiratory rate and the pulse were slightly increased - 56.8±1.18/min and 74.3±0.72/min respectively, while the rumination was decreased - 2.6±0.14 /2 min.

Table 3 – Dynamics of temperature, humidity, THI and wind speed during the synchronization period 2021 year

Days	t		Afternoon				
	F°	C°	40	45	50	55	60
1	86	30	77	*78*	78	79	80
2	87,8	31	78	79	*80*	80	81
3	91,4	33	80	81	82	83	*84*
4	96,8	36	84	85	86	*87*	88
5	87,8	31	78	79	*80*	80	81
6	69,8	29	76	76	77	*78*	78
7	73,4	29	76	76	77	*78*	78
8	78,8	26	72	73	73	74	*74*
9	86	30	77	78	*78*	79	80
10	93,2	34	82	83	*84*	84	85
11	93,2	34	82	*83*	84	84	85
12	93,2	34	82	83	*84*	84	85
13	86	30	77	78	*78*	79	80
14	89,6	32	79	80	*81*	82	83
15	84,2	29	76	76	*77*	78	78
16	84,2	29	76	76	*77*	78	78
17	89,6	32	79	*80*	81	82	83
18	87,8	31	78	79	*80*	80	81
19	86	30	77	78	78	*79*	80
20	87,8	31	78	79	80	80	*81*
21	77	25	71	71	*72*	72	73
22	77	25	71	71	*72*	72	73
23	77	25	71	71	*72*	72	73
24	77	25	71	*71*	72	72	73
25	87,8	31	*78*	79	80	80	81
26	91,4	33	*80*	81	82	83	84
27	86	30	77	78	*78*	79	80
28	82,4	28	74	75	76	*76*	77
29	75,2	24	70	70	*70*	71	71
30	78,8	26	72	73	73	*74*	74

Days	t		Night				
	F°	C°	40	45	50	55	60
1	82,4	28	74	*75*	76	76	77
2	80,6	27	73	74	*74*	75	76
3	80,6	27	73	74	74	75	*76*
4	84,2	29	76	76	77	*78*	78
5	68	20	65	65	*65*	66	66
6	84,2	21	66	66	67	*67*	67
7	84,2	23	68	69	69	*70*	70
8	69,8	21	66	66	67	67	*67*
9	75,2	24	70	70	*70*	71	71
10	80,6	27	73	74	*74*	75	76
11	84,2	29	76	*76*	77	78	78
12	78,8	26	72	73	*73*	74	74
13	82,4	28	74	75	*76*	76	77
14	78,8	29	76	76	*77*	78	78
15	84,2	26	72	73	*73*	74	74
16	80,6	27	73	74	*74*	75	76
17	78,8	26	72	*73*	73	74	74
18	80,6	27	73	74	*74*	75	76
19	80,6	27	73	74	74	*75*	76
20	82,4	28	74	75	76	76	*77*
21	75,2	24	70	70	*70*	71	71
22	77	23	68	69	*69*	70	70
23	78,8	23	68	69	*69*	70	70
24	75,2	24	70	*70*	70	71	71
25	77	25	*71*	71	72	72	73
26	80,6	27	*73*	74	74	75	76
27	78,8	26	72	73	*73*	74	74
28	82,4	25	71	71	72	*72*	73
29	78,8	22	67	67	*68*	68	69
30	80,6	23	68	69	69	*70*	70

Note: Temperature in Fahrenheit (F), Celsius (°C).

56-70 Thermal stress threshold.

71-79 Minimal heat stress.

80-89 Average heat stress.

71-79 - THI indicators

At day 30 days after synchronization, 94.6 ± 2.92% of the cows were diagnosed pregnant while on day 60, 88.6 ± 4.10% of the cows were confirmed pregnant indicating that 6% of cows underwent early embryonic mortality.

Discussion

The study aimed to determine the influence of the temperature humidity index (THI) on the efficiency of estrus synchronization on both beef and dairy cows. The results have shown that the effect of THI before, during and after estrus synchronization is a limiting factor of the effectiveness of its success. These results are consistent with the results of some previous studies reported by other authors [12], who reported that decreased success might be as a result of reduced function of the theca and granulosa cells during the heat stress. In addition, A. Duvanov [5] reported that increased THI negatively affects the oocyte maturation resulting in lower fertility rate and decreased pregnancy rate by 5-7%.

In addition, due to the negative impact of THI, the estrus behavior and its detection are reduced leading to decreased fertility that is consistent with the results reported by Rolando, P. L., Sandoval-Monzón (2022) [13]. Thus, a decrease in the frequency of estrus detection might be as a consequence of the negative impact of THI either on the estrus behavior or decreased level of estradiol-17 [14]. In addition, THI reduces the fertility rate, because THI might have a negative impact either on the oocyte or on the early embryo development.

It is well known that the germ cells of the females are embedded in the ovaries from birth and undergo various changes during sexual development. According to a number of authors, the follicle and the oocytes could be damaged by heat stress long before ovulation [15].

Table 4 – Dynamics of temperature, humidity, THI and wind speed during the synchronization period 2022 year

Days	t		Afternoon			
	F°	C°	35	40	45	50
1	80,6	27	73	*73*	74	74
2	82,4	28	74	*74*	75	76
3	84,2	29	75	*76*	76	77
4	77	25	*70*	71	71	72
5	77	25	70	71	*71*	72
6	77	25	70	71	*71*	72
7	78,8	26	71	*72*	73	73
8	82,4	28	74	74	75	*76*
9	82,4	28	74	*74*	75	76
10	77	25	70	71	*71*	72
11	86	30	*76*	77	78	78
12	71,6	22	67	*67*	67	68
13	84,2	29	75	*76*	76	77
14	87,8	31	77	*78*	79	80
15	68	20	*64*	65	65	65
16	68	20	64	*65*	65	65
17	75,2	24	69	70	*70*	70
18	71,6	22	*67*	67	67	68
19	66,2	19	63	63	*64*	64
20	73,4	23	68	*68*	69	69
21	93,2	34	81	82	*83*	84
22	75,2	24	69	70	*70*	70
23	73,4	23	68	68	*69*	69
24	71,6	22	67	*67*	67	68
25	86	30	76	*77*	78	78
26	69,8	21	66	66	*66*	67
27	68	20	64	*65*	65	65
28	69,8	21	66	*66*	66	67
29	68	20	64	65	65	*65*
30	77	25	70	71	71	*72*

Days	t		Night			
	F°	C°	35	40	45	50
1	73,4	23	68	*68*	69	69
2	68	20	64	*65*	65	65
3	64,4	23	68	*68*	69	69
4	77	22	*67*	67	67	68
5	62,6	17	61	61	*61*	61
6	66,2	19	63	63	*64*	64
7	71,6	22	67	*67*	67	68
8	78,8	26	71	72	73	*73*
9	78,8	26	71	*72*	73	73
10	82,4	23	68	68	*69*	69
11	71,6	22	*67*	67	67	68
12	68	20	64	*65*	65	65
13	75,2	24	69	*70*	70	70
14	77	25	70	*71*	71	72
15	59	15	*59*	59	59	59
16	62,6	17	61	*61*	61	61
17	68	20	64	65	*65*	65
18	62,6	17	*61*	61	61	61
19	50	15	59	59	*59*	59
20	59	18	62	*62*	62	63
21	66,2	30	76	77	*78*	78
22	69,8	21	66	66	*66*	67
23	77	19	63	63	*64*	64
24	84,2	20	64	*65*	65	65
25	77	25	70	*71*	71	72
26	78,8	19	63	63	*64*	64
27	80,6	17	61	*61*	61	61
28	68	20	64	*65*	65	65
29	69,8	17	61	61	61	*61*
30	60,8	21	66	66	66	*67*

Note: Temperature in Fahrenheit (F), Celsius (°C).

56-70 Thermal stress threshold.

71-79 Minimal heat stress.

80-89 Average heat stress.

71-79 - THI indicators

There is an evidence that the early embryo development is sensitive to the negative effects of environmental factors. Studies by Miętkiewska, K. et al. (2022) found out that cows that are heat stressed on the 1st day after estrus have reduced fertility and early embryo development, while s on the 3rd day the heat stress had no effect [16] that is similar with the results of our study. During the 2020-2022 our results indicated that 10 days before the estrus synchronization, cows were heat stressed which to a certain extent might have an influence on the dynamics of the follicle maturation. According to a number of authors, THI reduces fertilization three days before AI [17].

In addition, our results have shown that THI affected the some clinical parameters, causing decreased feed consumption, moderately increased temperature, increased respiratory and pulse rate similarly to the results reported by other researchers [18].

Moreover, our results showed that when the THI increases the fertility rate decreases. In 2021, when THI was increased by 5.6±0.03 compared to 2020, the fertility decreased by 9.7±0.78. Similarly, when THI was increased by 7.3 ± 0.56 compared to 2022, fertility was reduced by 13.8 ± 0.36, which is concomitant with the results reported by other authors [19].

Conclusion

Based on the results, there is an influence of THI on the effectiveness of estrus synchronization. Increased THI, to a certain extent, reduces both estrus expression and effectiveness of estrus synchronization leading to reduced fertility rate and increased embryonic mortality.

REFERENCES

1 Lozova, L.V. The influence of the season on the reproductive ability of highly productive cows. Young scientists in solving urgent problems of science [Text] / L.V. Lozova [and etc.] //

Materials at the VIII Scientific and Practical International Conference. Vladikavkaz. - 2018, - p.224-227

2 Nizikova, E.V. The influence of the season on the reproductive function of cows in the dairy complex [Text] / E.V. Nizikova // Scientific problems of livestock production and improvement of its quality materials of the XXXIII scientific and practical conference of students and postgraduates Bryansk region, May 17-19, - 2017. - p.110-112.

3 Kislyakova, E.M. Modern biotechnological methods in reproduction of cattle herds [Text] / E.M. Kislyakova [and etc.] // Fundamentals and prospects of organic biotechnologies. – 2021. – No 2. – p. 7-10

4 Tegza, A.A. Fertility of cows under thermal stress [Text] / A.A. Tegza [and etc.] // 3I: Intelligence, idea, innovation - Intelligence, idea, innovation. Multidisciplinary scientific journal of Kostanay Regional University named after A. Baitursynov. – 2022. – No 2. – p.21-27 https://doi.org/10.12345/22266070_2022_2_20 (in English)

5 Duvanov, A. The use of embryo transplantation technology to increase the fertilization of Holstein cows during heat stress. [Text] / A. Duvanov// from (11.08.2022).

[Electronic resource] // https://dairynews.today/news/primenenie-tekhnologii-transplantatsii-embrionov-d.html

6 Stojanov, B. Induction and formation on accessory corpus luteum after artificak insemination (AI) might increase pregnancy rate per AI in heat stressed dairy cows [Text] / B. Stojanov [and etc.] // Mac Vet Rev. – 2020. Vol 43, No 1. p.37-43. https://doi.org/10.2478/macvetrev-2020-0012

7 Brigida, A.V. Factors influencing the reaction response of ovaries of donor cows of embryos with the introduction of exogenous gonadotropins (review) [Text] / A.V. Brigida [and etc.] // Achievements of science and technology of the agro–industrial complex. – 2018. – Vol. 32, No.6. p.56-63. https://doi.org/10.24411/0235-2451-2018-10614

8 Search, Bo G. A. for a method of single administration of pFSH for superstimulation of cattle [Text] / G. A. Bo [and etc.] //Theriogenology. - 2017. Volume 112. P. 26-33.

9 Duvanov, A. Embryo transplantation under heat stress [Text] / A. Duvanov// https://dairynews.today/news/transplantatsiya-embrionov-pri-teplovom-stresse-ko.html cows (11.08.2022)

10 Khan, I. Heat Stress as a Barrier to Successful Reproduction and Potential Alleviation Strategies in Cattle. [Text] / I. Khan [and etc.] //Animals (Basel). - 2023. – No121. - p.745-751

11 Mr. Kosovsky.Yu. Embryoproductivity during induction of superovulation by a prolonged form of the drug FSH-super cows of the Kalmyk breed during reproduction [Text] / Mr. Kosovsky.Yu. [and etc.] // Proceedings of the Nizhnevolzhsky agrouniversitetskiy complex: science and higher professional education. – 2015. – № 2 (38). - P.148-152.

12 Nishisozu, T. Effects of the temperature-humidity index on conception rates in Holstein heifers and cows receiving in vitro-produced Japanese Black cattle embryos. [Text] / T. Nishisozu [and etc.] // The Journal of reproduction and development. – 2023. - P.72-77

13 Rolando, PL. Temperature-humidity index and reproductive performance of dairy cattle farms in Lima, Peru [Text] / PL Rolando [and etc.] //Open veterinary journal. - 2022. - p. 399-406.

14 Cardone Daniela. Daniela Cardone Effects of short-term in vitro heat stress on bovine preantral follicles [Text] / Cardone Daniela [and etc.] // Livestock Science. – 2022. - No 10. - P.322-333.

15 Khan, A.[Text] SOD1 Gene Silencing Promotes Apoptosis and Suppresses Proliferation of Heat-Stressed Bovine Granulosa Cells via Induction of Oxidative Stress [Text] / A. Khan [and etc.] // Veterinary sciences. 2021.No 8. P.326.

16 Miętkiewska, K. [Text] Effects of Heat Stress on Bovine Oocytes and Early Embryonic Development-An Update [Text] / K.Miętkiewska [and etc.] // Cells, 2022. No 11. P.4073.

17 Rosales-Martínez, F. (2020). Relation of the maximum temperature and relative humidity close to the insemination with the tropical milking criollo heifer's gestation in three seasons [Text] / F. Rosales-Martínez [and etc.] // Tropical animal health and production. No 53 (1), P.27. https://doi.org/10.1007/s11250-020-02430-3

18 Belousov, A.I. The effect of heat stress on cows in the dry and postpartum periods [Text] / A.I. Belousov [and etc.] // Bulletin of the NGAU (Novosibirsk State Agrarian University). – 2022. No (3). P.93-101. https://doi.org/10.31677/2072-6724-2022-64-3-93-101 (in Russian)

19 Webb. E.K. The influence of milk urea nitrogen (MUN) and climatic factors on the reproductive efficiency of Holstein-Frisian and Jersey cows in the subtropics [Text] / E.K Webb., E.de Bruyne //Animals (Basel). 2021. October 27. No11(11). P.3068. doi:10.3390/ani11113068

ТҮЙІН

Жұмыс етті мал шаруашылығындағы өсіп-өну мәселелерін зерттеуге арналған. Етті мал шаруашылығын қарқындату және өсіп-өну мәселелерін шешу үшін ғалымдар сиырлардың күйлеуін сәйкестендіру әдісін ұсынады. Зерттеулер Қазақстан Республикасы Шығыс Қазақстан облысы, Бесқарағай ауданының "Азамат" АӨК шаруашылығы жағдайында жүргізілді. Аталған аймақтың табиғи-климаттық жағдайлары ет бағытындағы малды да, сүт бағытындағы малды да өсіруге мүмкіндік береді. Экспериментте 3-5 жас аралығындағы қазақ ақбас тұқымды 408 сиыр болды. Қоршаған ортаның температуралық-ылғалдылық индексінің (THI) сиырлардың күйлеуін сәйкестендіру нобайларының тиімділігіне және қолдан ұрықтандырудың нәтижелілігіне ықпалын зерттедік.

Тәжірибе кезінде ауа температурасы (T), салыстырмалы ылғалдылық (φ), жел жылдамдығы (υ) туралы мәліметтер жиналып, температура-ылғалдылық индексі (THI) анықталды. Деректер 30 күн бойы жазылды (сиырлардың күйлеуін сәйкестендіру нобайларының 10 күн бұрын, сиырлардың күйлеуін сәйкестендіру нобайларының кезінде 10 күн және кейін 10 күн). Сонымен қатар, сиырлардың күйлеуін сәйкестендіру нобайларының кезінде жануарлардың 10% күнделікті клиникалық көрсеткіштері - дене температурасы (t), тамыр соғысы (P), тыныс алу жиілігі (Re) және сағыз (R) әдеттегі әдістермен өлшенді.

THI сиырлардың жыныстық қызметін ынталандыру мен сәйкестендіру тиімділігіне ықпалы анықталды. THI жоғарылауы сиырларда эструстың байқалуына белгілі бір дәрежеде ықпал етті және күйлеуді сәйкестендірудің тиімділігін төмендетті, ұрықтану көрсеткіші төмендеп, эмбрионалдық өлім байқалды.

РЕЗЮМЕ

Целью данного исследования было определить влияние температурно – влажностного индекса (THI) на эффективность синхронизации половой охоты у коров, как у мясных, так и у молочных. Исследование проведено на СПК «Азамат» Бескарагайского района Восточно-Казахстанской области Республики Казахстан. Природно-климатические условия данной зоны позволяют разводить скот как мясного, так и молочного направления продуктивности. В эксперименте были 408 коров казахской белоголовой породы в возрасте от 3 до 5 лет.

В течение экспериментального периода собирали данные по температуре воздуха (T), относительной влажности (φ), скорости ветра (υ) и определяли температурно-влажностный индекс (THI). Данные записывались в течение 30 дней (10 дней до синхронизации, 10 дней во время синхронизации и 10 дней после синхронизации). Кроме того, в период проведения синхронизации половой охоты у коров у 10% животных общепринятыми методами ежедневно измеряли клинические параметры - температуру тела (t), пульс (P), частоту дыхания (Re) и жвачку (R).

За экспериментальный период (2020-2022 гг.) THI составлял 74,50±1,31, 78,20±2,11, 72,80±0,7210 до синхронизации половой охоты. При увеличении THI на 5,6±0,03 в 2021 г. по сравнению с 2020 г. рождаемость снизилась на 9,7±0,78. Точно так же, когда THI увеличился на 7,3 ± 0,56 по сравнению с 2022 годом, рождаемость снизилась на 13,8 ± 0,36. Последнее указывает на то, что при увеличении THI коэффициент фертильности снижается.

Установлено влияние THI на эффективность стимуляции и синхронизации половой функции коров. Повышение THI в определенной степени влиял на проявление эструса и снижал эффективность синхронизации половой охоты, что проявлялось снижением оплодотворяемости и проявлением эмбриональной смертности у коров.

Установлено влияние THI на эффективность стимуляции и синхронизации половой функции коров. Повышение THI в определенной степени влиял на проявление эструса и снижал эффективность синхронизации половой охоты, что проявлялось снижением оплодотворяемости и проявлением эмбриональной смертности у коров.