Study on the effect of maintenance operations and season on the traction of natural grass pitches

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Introduction and Objective

Introduction and Objective

- Shoe-surface interaction is important for both the performance (improvement of performance during displacements, sprints, changes of directions,…) and safety of athletes (exessive or insufficient traction can lead to injury).

- This shoe-surface interaction depends on a lot of factors, for example **climatic conditions**, **surface properties**, **footwear** (number, size and shape of studs)…



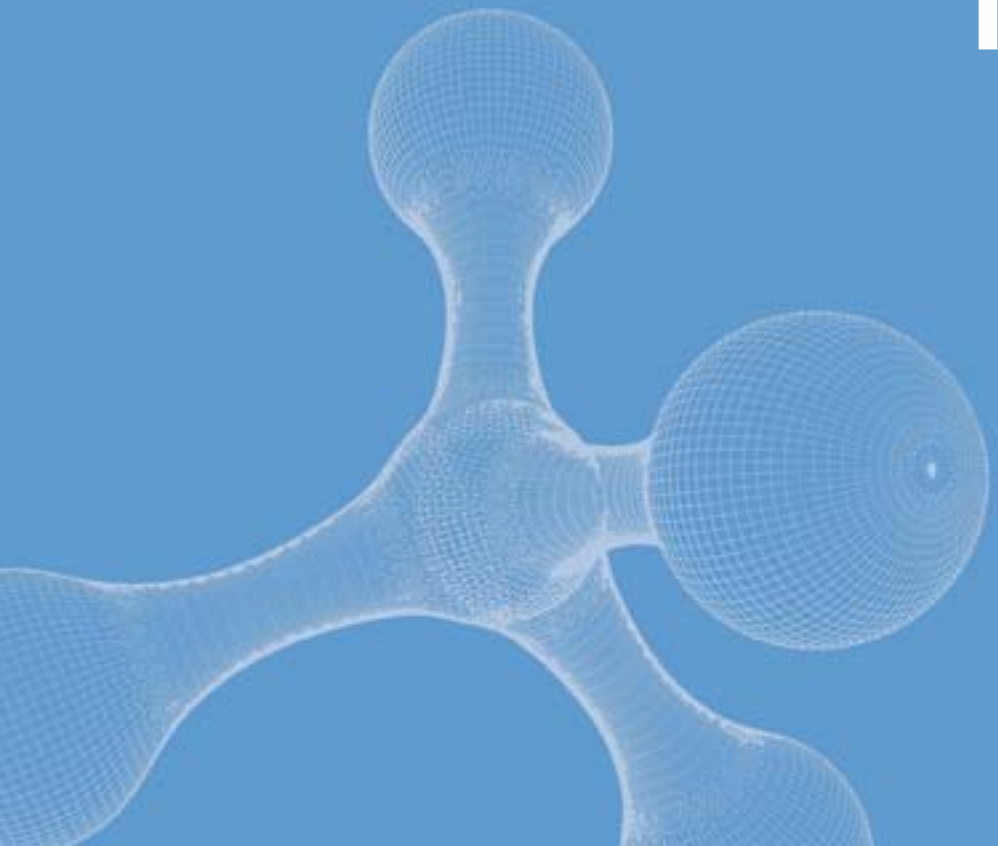


Introduction and Objective

- It is possible to act over surface traction by means of maintenance operations.
- It is necessary to know the influence of each of these maintenance operations and season on this property.

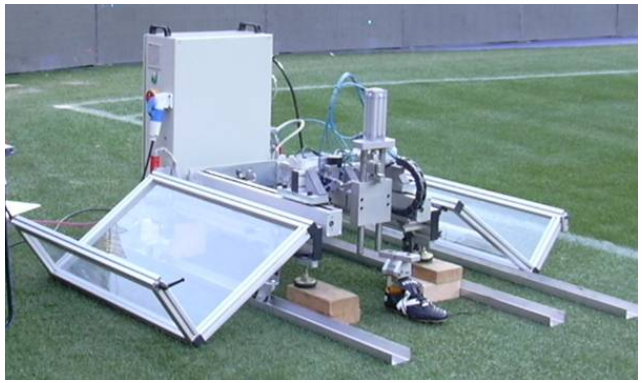
OBJECTIVE: to know the influence of seasons and maintenance operations on the traction of natural grass pitches.

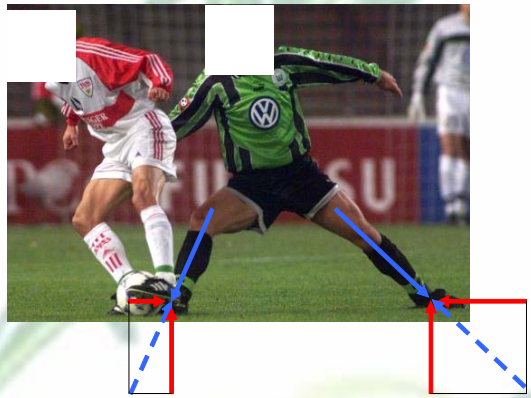
Materials and Methods



Materials and Methods

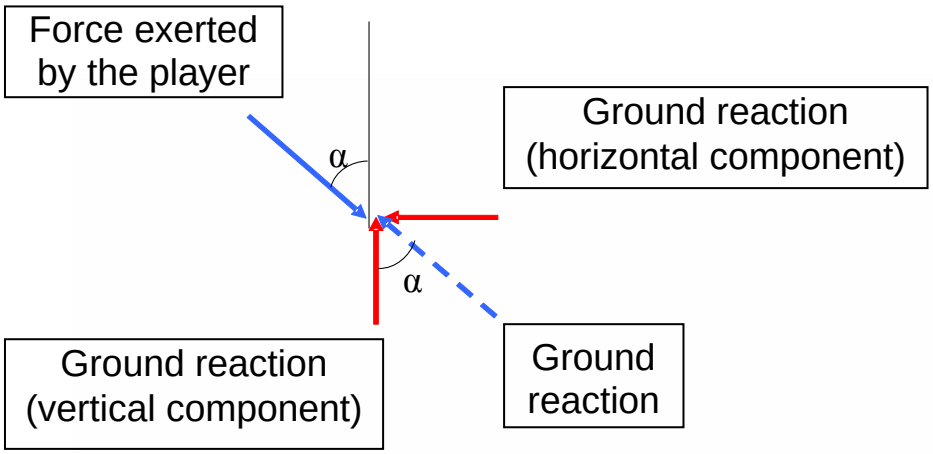
- IBV has developed a method consisting of a machine capable of reproducing the lateral displacements that sportsmen make in their natural movements during matches.

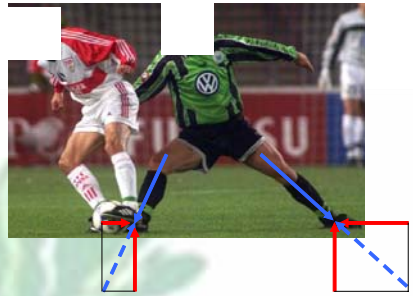




- The movement of this machine consist of a horizontal displacement at controlled velocity, recording the horizontal force necessary to produce the displacement (vertical force = 150 N; velocity = 0.4 m/s).

Materials and Methods

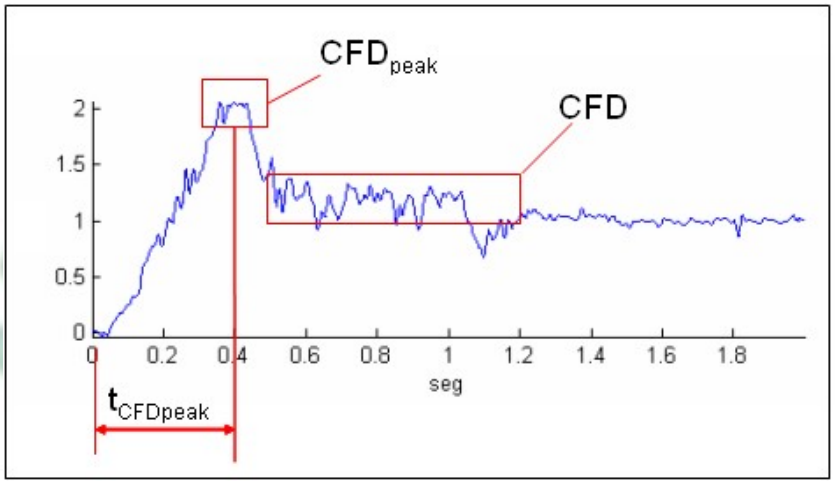


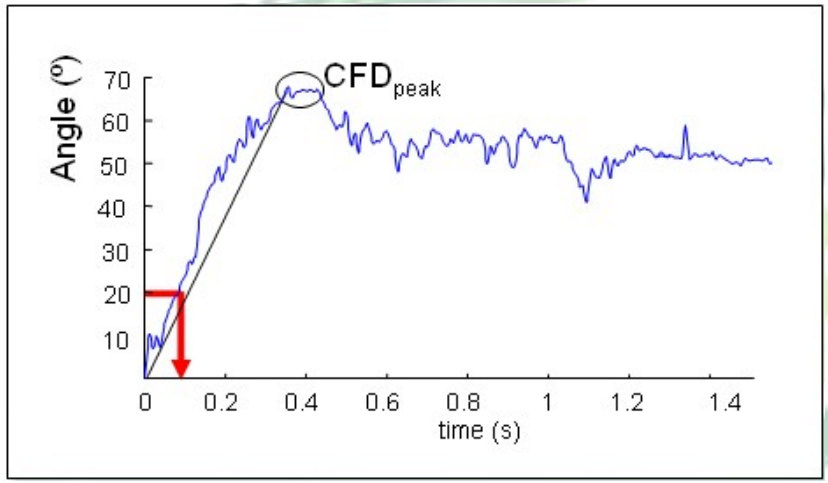


$$CFD = \frac{Fh}{Fv}$$

$$tg\ \alpha = \frac{Fh}{Fv}$$

$CFD = tg\ \alpha$; $\alpha = actg(CFD)$



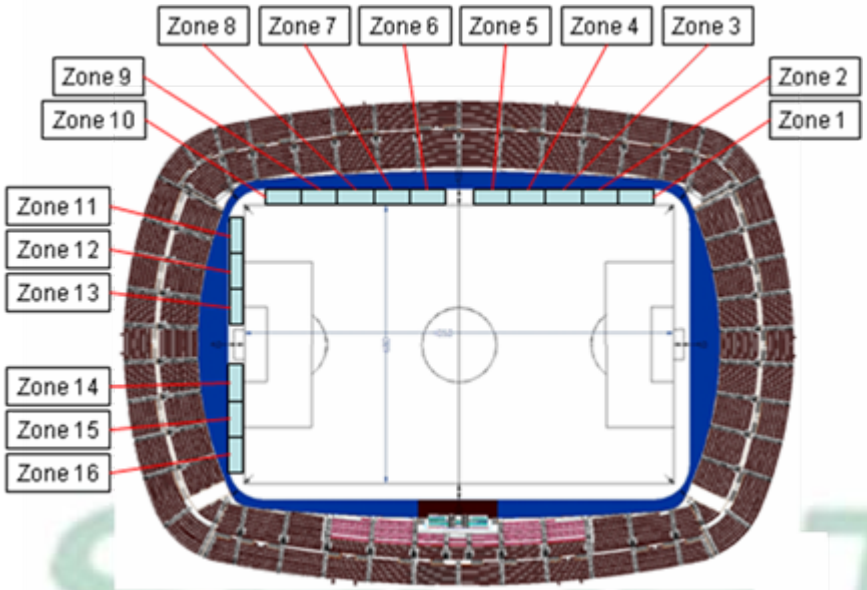


Materials and Methods

- The variables obtained from this test are:
  - CFD_{peak}: maximum traction during the initial transit. It is related to grounds' resistance limit and, therefore, the maximum traction avaliable prior to commencing the inevitable sliding.
  - t_{20}: time required for stablishing the support for a determined leg slope (20º in this study). It is related to the appearance of an unexpected lack of stability on support being produced due to a delay in traction contribution from the ground.

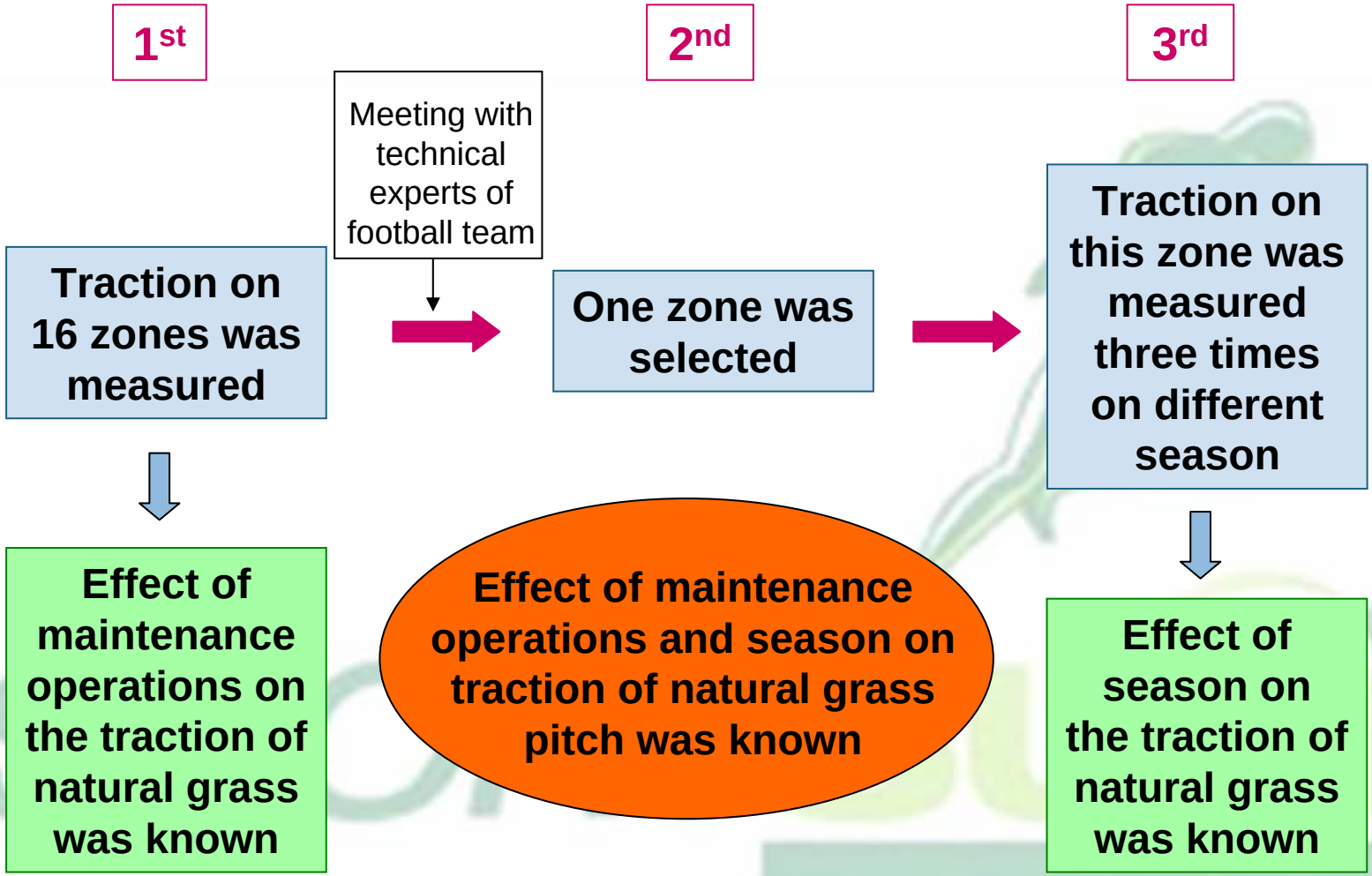
Materials and Methods

- Sixteen zones after different maintenance operations for each one were studied.

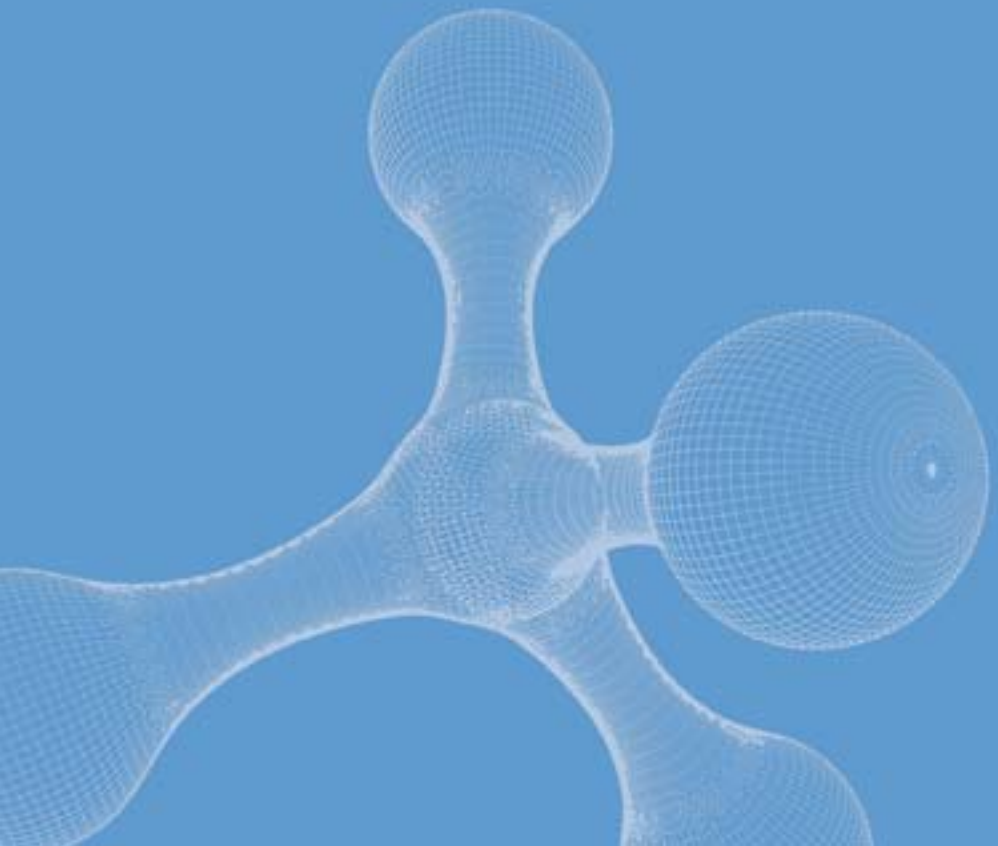


Zone	I L	S L	T P A (cm)	C H	C F	HoC (mm)
1	low	normal	6	no	no	12
2	high	low	6	no	no	12
3	low	high	6	yes	no	25
4	high	high	10	yes	yes	12
5	normal	high	6	no	yes	12
6	normal	normal	10	yes	no	12
7	high	low	10	yes	no	12
8	high	high	6	no	yes	12
9	low	high	10	yes	yes	12
10	normal	low	6	yes	yes	25
11	high	normal	6	yes	yes	17
12	normal	high	10	no	no	17
13	high	high	10	no	no	25
14	high	high	6	yes	no	17
15	low	low	10	no	yes	17
16	high	normal	10	no	yes	25

Materials and Methods



Results



Results

- From a design of experiments, 16 zones were studied after different maintenance operations.
- The data was processed and the results obtained…

Results

Maintenance operations

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15	low	low	10	no	yes	17
16	high	normal	10	no	yes	25

Mechanical test results

Zone	CFD_{peak}	Standard deviation CFD_{peak}	t_{20} (s)	Standard deviation t_{20}
1	1.689	0.109	0.192	0.004
2	1.766	0.046	0.140	0.006
3	1.639	0.104	0.154	0.003
4	1.930	0.031	0.146	0.003
5	1.636	0.168	0.138	0.004
6	1.973	0.150	0.156	0.011
7	1.661	0.034	0.136	0.016
8	1.897	0.131	0.148	0.013
9	2.066	0.123	0.144	0.005
10	1.702	0.306	0.138	0.016
11	1.835	0.217	0.170	0.010
12	1.731	0.041	0.148	0.008
13	1.743	0.032	0.138	0.009
14	1.852	0.202	0.144	0.016
15	1.519	0.097	0.142	0.009
16	1.668	0.182	0.130	0.007

Results

CFDpeak

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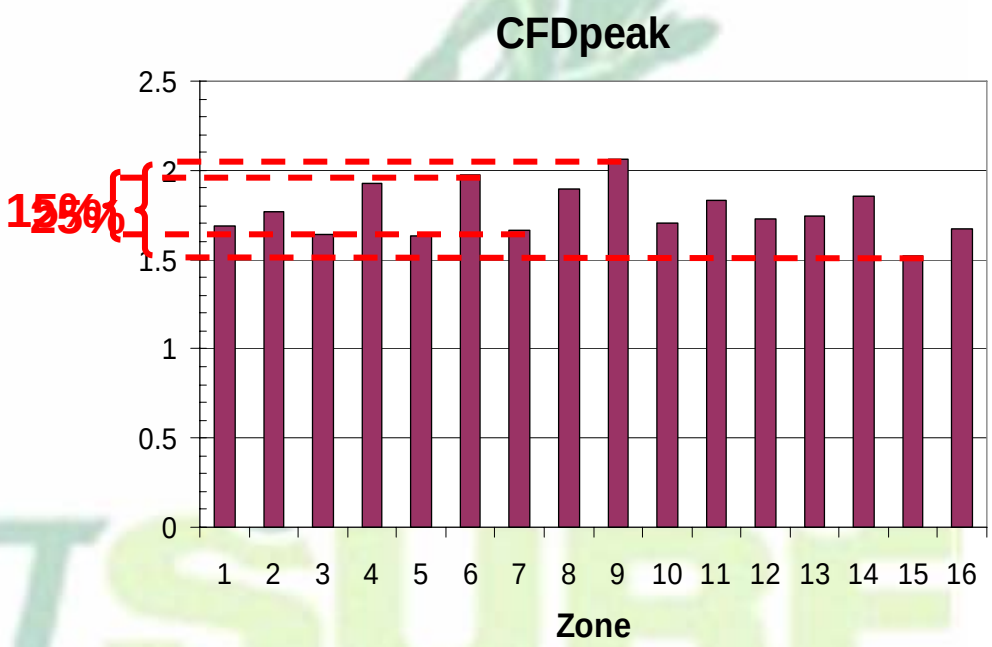

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t_{20}

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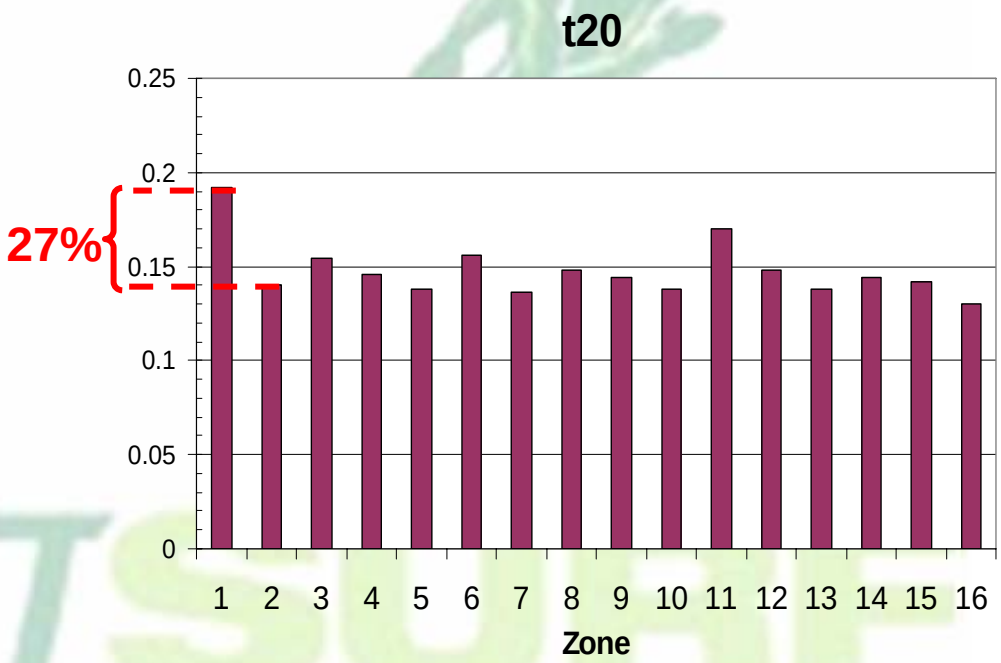

Results

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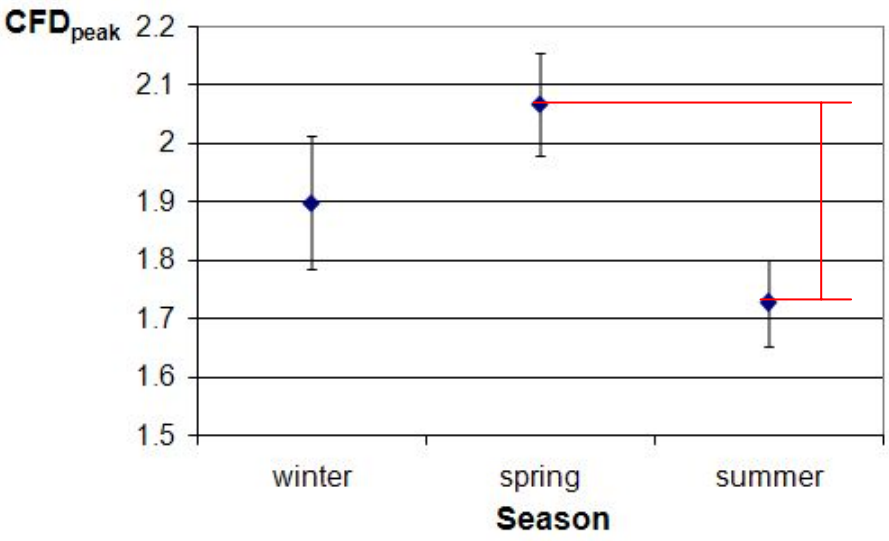
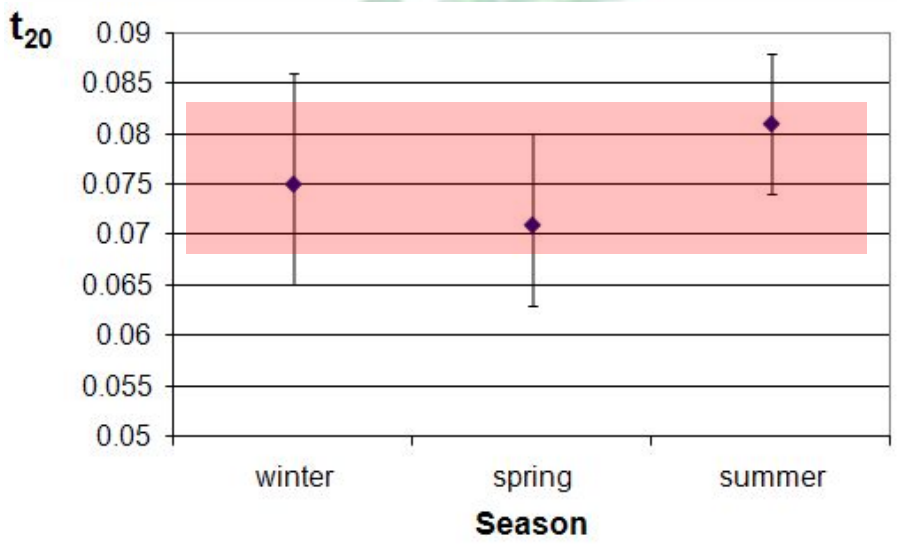
Results

- After one zone was selected, the study of traction in this one was carried out in three different seasons:
  - Winter (January)
  - Spring (April)
  - Summer (July)

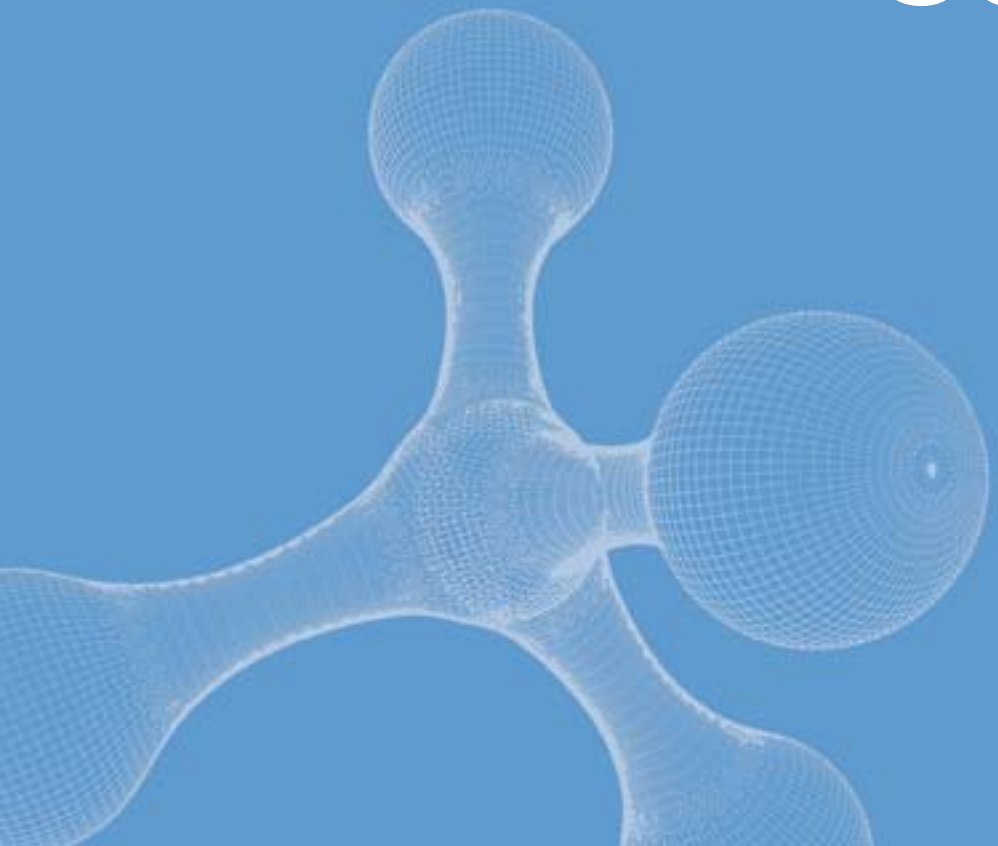
Results

Mechanical test results on zone 8 (different season)





Conclusions



Conclusions

- Maintenance operations and season influence traction of natural grass.

- Maintenance operations:
  - using chain harrow and rising sand layer thickness traction increases.
  - increasing on height of the grass, traction is reduced.
  - an increase of irrigation level and on the height of the grass causes a decrease of t_{20}.
  - an increase of sand layer thickness causes a decrease of t_{20}.

- Season:
  - in summer, CFD_{peak} is lower than in other seasons.
  - t_{20} is similar in the course of time.

Conclusions

- A high t_{20} together with a reduced traction can cause the player slip and a low value of this parameter increase the severity of the stopped.
- It is difficult to know the suitable value of this parameter but to keep a constant value along the time and in all the pitch is very important to ensure the response of the pitch expected by the players.
- It is necessary to relate the traction of the fields to injuries (ligaments, …).

Thanks for your attention!!

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