Why choose natural turf?

A discussion on natural versus artificial turf for sport and leisure applications

Presented by ESA – European Seed Association
Section Forage Plants and Amenity Grasses (SFG)

An introduction to this document

If you're thinking of buying and installing a new sports pitch, then you have many factors to consider before making that decision – and one of these is whether to choose natural turfgrass or an artificial surface.

The Section Forage Plants and Amenity Grasses (SFG) of the European Seed Association (ESA) has produced what is probably the most up-to-date comparison available for natural versus artificial turf for sports and leisure applications. In this discussion document, we present in clear factual detail why we believe natural turf to be the best long-term solution for the industry.

The evidence is clear – natural turfgrass is perfect for the environment, it's extremely healthy and safe for players, the most cost-effective alternative to install and maintain, and the majority of football players and even spectators prefer it.

ESA's report also shows that dedicated research and development of grass seed breeders has ensured a healthy future for natural turf. Thanks to their work, particularly in the last decade, natural grass solutions are now available that can tackle pitch problems such as shade, air circulation and persistency in almost every situation – however extreme the conditions.

Additionally, advances in pitch construction, drainage, nutritional programmes and maintenance expertise mean that natural turf is easier to install and maintain than ever before.

There *is* a place for artificial turf, but before you make a decision to purchase a new sports pitch, we invite you to consider all the facts assembled in this document.

ESA Mission Statement

ESA is the voice of the European seed industry, representing the interests of those active in research, breeding, production and marketing of seeds of agricultural, horticultural and ornamental plant species.

Plants from seed are the origin of all food, provide innovative and environmentally friendly industrial products and beautify our landscape.

ESA's mission is to work for:

- effective protection of intellectual property rights relating to plants and seeds
- fair and proportionate regulation of the European seed industry
- freedom of choice for customers (farmers, growers, industry, consumers) in supplying seeds as a result of innovative, diverse technologies and production methods.

What are the benefits of natural grass?

According to scientists, our climate is changing rapidly and this has major consequences for flora and fauna – and for human health in particular. Air pollution is everywhere. To help reduce carbon dioxide in the atmosphere, world conferences are regularly organised to encourage countries to stop this fatal process.

In this framework, natural grass can be a great help. Unfortunately, not many people are aware of this fact and have overlooked the positive contribution of oxygen production and carbon dioxide fixation natural grass brings. People are understandably more concerned about the loss of one hectare of rain forest than one hectare of grass. Although both are very important, it is an interesting fact that the annual oxygen production and carbon dioxide fixation from one hectare of grass exceeds that of one hectare of forest!

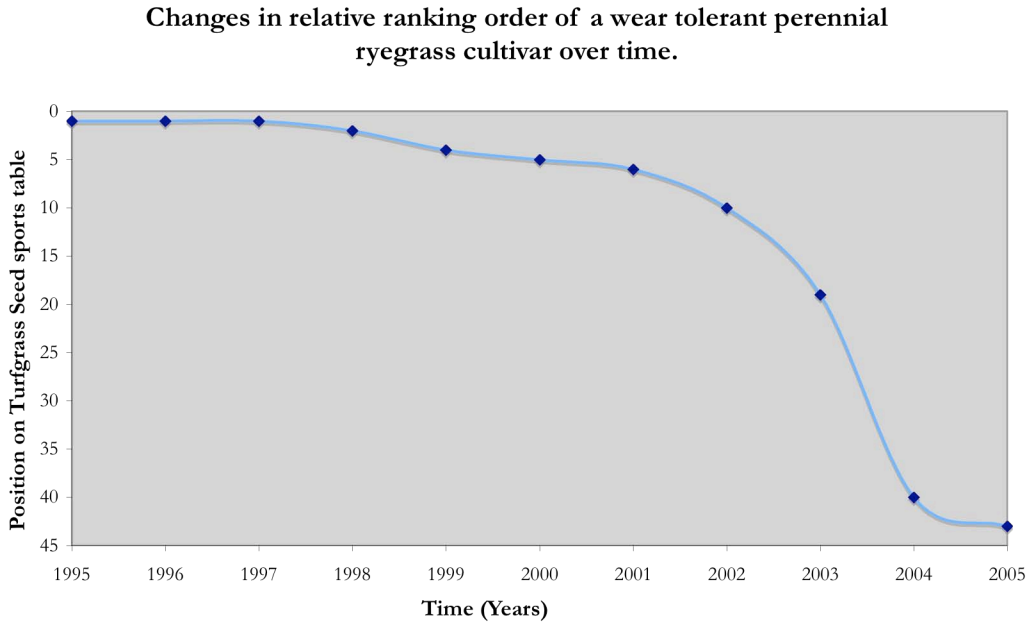
Grass has so much more to offer

In addition to its positive environmental characteristics, natural grass is a safe product to play on. It absorbs heat from sun on the pitch, the risk of injury is very low, it's cheap and, last but not least, it's self-repairing. What other product can do all this?

Improvements in plant breeding over the last 10 years

Breeding grasses for leisure is a fairly young business. It started on a larger scale in the 1960s, but real focus on sports grass breeding only became more common in the early 1990s. It takes an average of 15 years to breed a new variety. The progress made by grass breeders in the last decade is impressive, and natural grass solutions are now available that can tackle pitch problems – for example shade, air circulation, and persistency – in almost every situation. Figure 1 (below) illustrates the progress made in wear tolerance in the last five years. A particular perennial ryegrass variety with excellent wear tolerance dropped from being ranked top in 1995 to position 42 because better wear tolerant varieties were released from the breeding programmes.
(Source: STRI-Bingley, UK).

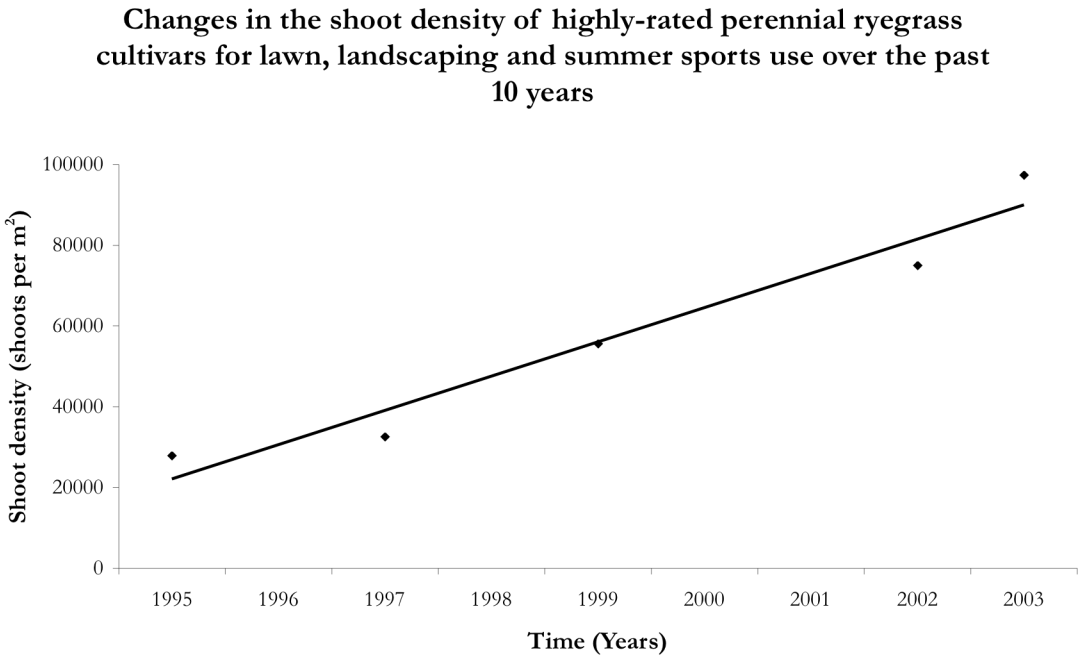
Figure 1



Improved density

Over the last 10 years, shoot density has steadily been improved. For sports use, the increased density, together with increased strength of recovery, means significant improvement in wear tolerance. Figure 2 (below) shows the increase in shoot density over the last 10 years of highly rated perennial ryegrass varieties on the STRI-Bingley list (Source: STRI).

Figure 2



This means that top varieties with shoot densities of approximately 25,000 shoots per m^2, which were ranked top of the Bingley sports variety list in 1995, have now been outclassed and are pushed to the bottom in the 2005 issue of the same list because better varieties have appeared.

Improved shade tolerance

To comply with conditions in the new multi-stadiums, breeders have for a number of years been testing and selecting under shady conditions using special tents which allow only partial light to pass though (see picture below). The result has been that it's now possible to recommend specific varieties with improved wear tolerance under shade for use in stadiums where shade is a problem.

Improved heat stress tolerance

Breeding has made it possible to play football on natural turf in all climatic areas in the world. Grass species and varieties for sports pitches are now available specifically for areas with water shortages, such as Africa. Breeders put a lot of effort into breeding grasses with improved heat and drought stress tolerance. The picture below shows drought tolerance trials being carried out on sports turf in the South of France.

New grass species

Improvement in well-known species for sports pitches has been substantial, but there have also been huge advances in the breeding of new species. New varieties have been brought onto the market for the species fescues, poas and deschampsia. When used under the correct conditions and management, these new innovations can bring benefits never seen before.

The future is bright for natural grass

According to the majority of football players, nothing compares with playing on natural grass. The significant progress in the genetics of natural grass, plus new ways of constructing the rootzone of sports fields and the expertise in pitch management, has made playing football on muddy fields a thing of the past.

What are the health and safety aspects of artificial turf?

The issue of the health and safety aspects of artificial turf is very sensitive, particularly regarding litigation, where it could be shown that playing on artificial turf has directly contributed to injury. Litigation also depends on the present national legal environment. For this reason, conclusive evidence is difficult to find and what evidence there is – whether firm or anecdotal – is liable to have originated in the US where:

- artificial turf 'originated'
- the number of artificial turf playing areas is larger
- experience of artificial turf is higher
- the environment is litigious.

Turfgrass Producers International (TPI) – the international trade association for turf or sod producers – has been actively promoting the attributes of natural turf for a number of years and has many useful references. The thrust of their argument centres around numerous questions specifically concerning artificial turf that for the moment remain unanswered. (Source: TPI Newsletter, Turfnews – September/October 2004).

There is less information available on 'third generation' artificial pitches due to the limited amount of time they have been on the market, and the fact that problems associated with long-term play on artificial surfaces become apparent only after several years.

The artificial turf industry itself implements two quality control standards – The FIFA recommendation, and individual quality control standards concerning the components. The FIFA criteria are even based around readings for natural turf.

In general it seems there are two types of issues that are, or may be, cause for concern. These are: specific health and safety issues and general health and safety concerns.

Specific health and safety concerns

Injuries directly related to playing on artificial sports turf:

Turf Toe (first metatarsophalangeal joint sprain)
A painful 'jam' or hyperextension of the big toe. Although this is a condition that can occur on natural grass, it's more common on artificial turf. (Source: Foot Health Foundation of America).

ACL (Anterior Cruciate Ligament injuries)
Substantial research has been carried out in the US showing that this is a problem more common among female athletes, and more prevalent on artificial turf than natural. The problem seems to be linked to shoe-surface traction, which is higher on artificial turf than on natural grass. (Source: Orchard and Powell 2003). The National Football League (NFL) continues to monitor injuries, but results are confidential!

Foot Lock
This can occur when a player uses studs that are too long, preventing the foot turning and therefore putting abnormal stress on the knees. Some cities with pitches already installed advise their users to reduce the risk of injury by using long cleated (i.e. 11mm or longer) shoes and densely cleated shoes. (Source: www.nwpr.bc.ca/mercer%20stadium.html).

Concussion
Several NFL players have experienced career-ending concussion and a trial has been carried out in the St Louis area to compare a natural practice pitch, an indoor domed stadium and an artificial outdoor practice pitch. The indoor domed pitch was the hardest, and the authors of the report considered it may have contributed to the high incidence of concussion. (Source: Naunheim et Al October 2002).

Turf Burn
This develops when an athlete 'slides' an exposed area of skin across artificial turf. Because artificial turf has a lower co-efficient of friction than natural grass, especially when wet, the athlete slides a greater distance, thus generating heat and producing an injury that is part abrasion and part burn. (Source: www.physsportsmed.com).

Overall, the situation is far from clear, but there seems to be enough evidence here to merit further study.

In a 2004 Opinion Survey carried out by the US-based National Football League Players' Association (NFLPA), players were asked which surface they thought was more likely to contribute to injury. A staggering 91.18 per cent said artificial turf. (Source: TPI newsletter, Turfnews – August 2005).

Injuries indirectly related to playing on artificial sports turf:

MRSA – higher incidences of methicillin–resistant staphylococcus aureus infections
A study has shown a higher incidence of MRSA infection among American football players who play and train on artificial grass. It would seem that 'turf burn' abrasions create entry points for later MRSA infection in baths and whirlpools. (Source: Begier et al Nov 2004).

General health and safety concerns

Heat

It is well known that artificial surfaces have higher temperatures than natural grass. During 2002, Brigham Young University, in Utah, installed an artificial surface. One of the trainers received blisters through his training shoes, simply through walking on the surface. Subsequently, a study was made that showed the average temperature between 7am and 7pm was 117°F (47°C) with a high of 157° F (69°C) for artificial turf, and 78.19°F (26°C) with a high of 88.5° F (32°C) for natural grass. Irrigating reduced the temperature, but it quickly rose again. Even in shade artificial turf had a higher surface temperature than natural grass. (Source: Williams and Pulley, Brigham Young University).

The question of the need to irrigate to reduce surface temperature and maintain surface playing conditions is an important one, not only in terms of general water consumption, but also the quality of the water used. It is essential to use clean drinking water, or algae and slimes can build up on the fibres of the artificial turf. This is a vital consideration in light of the current discussions in some third world countries, as many already have little enough water to drink without having to use this water to irrigate artificial pitches!

What are the consequences for footballers playing on these hotter surfaces, and what are the effects of fumes generated from the rubber crumb used in the infill?

Bacteria

Natural turf contains many different bacteria which take care of pitch sanitation and 'clean up' human body fluids (sweat, spit, vomit, blood, urine etc) animal excreta, and algae. Some artificial turf manufacturers promote the absence of bacteria as a positive attribute. But how extensively are pitch sanitation products used and how effective are they?

Weeds and fungae

Contrary to what is believed, weeds and fungae can start to invade more established artificial pitches. But which products are registered for artificial pitches, given that the usage is different to that on purely inert areas, pavements, paths etc?

Rubber crumb

It has been pointed out that recycled rubber is used from old athletic shoes or tyres. But what are the consequences of playing on these fields and the associated fumes? Although not directly associated with play, artificial turf is promoted for use in densely populated urban areas where use is high. Unfortunately, these areas can also be the source of vandalism. What would be the effect of vandals setting fire to an artificial pitch in a densely populated area? (Example: Championship match 2005, San Siro stadium – Inter Milan).

Artificial turf does have a role to play in the future, and some problems associated with artificial turf can also be associated with natural grass. But the scale of problems with natural grass is well known and has been studied over a long period of time. This is not yet the case with artificial grass. We are dealing with an unknown that could have a direct influence on players. Are these aspects fully taken into account when the choice to 'go artificial' is made?

What are the environmental implications of artificial turf?

Waste and recycling

Each year an artificial pitch 'loses' approximately three tonnes of material (refill rubber granulates and sand), just through normal play. But there is a lack of information about where this material disappears to and what effect it may have on the environment and human health. (Source: DBU (Danish Football Association) website – www.dbu.dk).

The Turf Producers International (TPI) trade association is also looking into this.

A group of experts who have looked at problems with artificial football fields in Germany – called Initiative WM-Rasen e.v.-Weissbuch – found that renewal of an artificial football pitch produces 250 tonnes of waste. This comprises 20 tonnes of Polyethylen fibres, Polypropylen and latex (kautchuk/Butadienstyrol), plus 105 tonnes of rubber granulates and 127 tonnes of sand (with some rubber granulates).

Rubber granulate is used as fuel in the concrete industry and paying for its removal is standard practice. The sand can be placed in a landfill site without significant cost. The plastic is normally burned because, as with the rubber granulates, recycling it is very expensive.

The DBU has set up a working group to investigate recycling and other issues surrounding artificial pitches. There is a lack of scientific investigation being carried out in Denmark on this subject. (Source: DBU spokesperson).

Chemicals

Future use of salt on sand-based pitches for winter use can be questioned. The use of salt on artificial pitches, and the recommended application of approximately two tonnes per year of both sodium chloride and calcium, is subject to the same question. (Source: DBU website).

Andrew McNitt, of Pennsylvania State University, says that to avoid static build-up, and therefore the sticking of black rubber granules to the pile fibres, the application of dilute fabric softener has become standard practice for some pitch managers. However, this can make the pitch slippery.

A Special Task Force put together by the TPI in 2004 revealed that pitch sanitation has to be done by antiseptic cleaners. This raises a lot of questions about how combinations of chemicals behave on artificial pitches and how they affect players.

Environmental problems with rubber dust

The TPI Special Task Force questioned what is happening to the silica dust and cadmium particles from rubber. Results are pending.

CO^2-O^2 balance

Research by Initiative WM-Rasen e.v.-Weissbuch showed that a natural grass football pitch produces enough oxygen for 120 people per year. Football & Stadium Management magazine, January 2005, wrote that one acre of natural grass fixes 4.5 tonnes of carbon dioxide.

Pitchcare.com magazine states that one grass pitch provides more oxygen than one hectare of forest. (Source: www.pitchcare.com).

Obviously artificial turf does not contribute in this respect.

Water consumption

In the report by Initiative WM-Rasen e.v.-Weissbuch, cost comparisons between artificial and natural turf pitches doesn't include costs for irrigation of artificial pitches, but it's clear that watering is necessary before play.

FIFA recommends irrigating artificial turf to cool down the surface, to minimise the occurrence of skin burns (which occurs when skin temperature is above 60°C) and to stabilise the infill.

Irrigation of artificial pitches in colder climates is only necessary in order to speed up play. Under warm conditions in southern countries, irrigation is necessary in order to lower the temperature on the field through evaporation. In Denmark it will probably become standard to install automatic irrigation systems on artificial fields, as well as heating. These costs are not yet included in DBU budgets. (Source: DBU spokesperson).

Smell and air quality

The TPI Special Task Force looked into the gases released by artificial surfaces during a fire, and also in relation to fire fighters. Results are pending.

Artificial grass does not burn, as such, but melts. The Danish fire authority has forbidden the use of third generation artificial grass indoors, as the development of smoke would prevent people from escaping a fire. (Source: DBU spokesperson).

Concerns have been voiced that rubber from car tyres, which in some cases is used to make artificial pitches, could cause cancer and respiratory problems.

This could be a problem when using the pitch for other purposes as well. The DBU recommends the use of green artificial rubber (EPDM) instead of black tyre rubber. The EPDM doesn't smell, but costs three times more than black rubber. This means an extra 135,000 euros (£92,000) in establishment costs for a pitch. (Source: DBU spokesperson).

Michigan State University's Environmental Business News (a green building and design trade publication) reported that artificial turf releases volatile organic compounds which give off a "rubbery" smell that can cause problems for asthma suffers.

Algae on artificial turf

The TPI Special Task Force asks which chemicals can be used for controlling algae and weeds, and also takes into consideration the amounts of water used for cooling down a pitch. No chemicals are approved for this purpose because of run-off and contamination.

Algae can be controlled by twice-weekly brushing, but this adds to maintenance costs.

Chemicals company Ciba states on its website that algae and moss turn artificial turf an ugly green or brown colour and cause it to become slippery. The company recommends chemicals which contain colour pigments.

On its website, a UK turf maintenance machinery manufacturer mentions chemicals like Roundup, Dichlorophen and Ferrous Sulphate to fight algae. It is not stated if these chemicals are permitted for use on artificial grass! (Source: www.sisis.com).

There is a clear contradiction here, as the use of water for irrigation and cooling down will cause the chemicals used for algae and moss control to be washed away!

Leaching of chemicals

Research by InitiativeWM-Rasen e.v.-Weissbuch revealed that UEFA has acknowledged that the use of rubber granulates does not comply with all national environmental rules, and that groundwater can be polluted with zinc, cadmium, lead, mercury and other unwanted chemicals. In Berlin, the football association has abandoned the use of black rubber granulates because no guarantee against leaching and gas emission could be given from suppliers. Research also showed that natural grass binds dust and absorbs chemicals.

Norwegian Institute (Norsk byggeforsknings institut) is running a project for the Nordic Football Association on leaching from artificial fields. (Source: DBU spokesperson).

What are the investment and maintenance costs of artificial turf?

It can be shown that natural turf is very competitive compared with artificial turf. (See cost comparison between natural turf and artificial turf presented in Figure 3, page 16). Costs for establishing new sports pitches vary a lot between countries in Europe due to differences in material and labour costs, climatic conditions, soil conditions etc. For this reason, a spreading of costs is presented wherever the differences seem to be high.

Annual costs for artificial turf are very high and often much higher per playing hour than natural grass. This is caused by the very high investment costs for artificial turf. The differences between the maintenance costs are not as great as many people assume. This means that more money can be spent on maintenance for natural grass while still maintaining the cheapest alternative!

The cost of a rubber infilled field is between 500,000 and 600,000 euros (£340,000 and £408,000), including lighting and fencing. For this investment you will get a field suitable for more than 1,000 playing and training hours per year. The 1,000 hours is probably only achievable for very large football clubs with many members, because it means at least three hours of use on every day of every week of the year. How many clubs will achieve this?

The presented 900 hours of use in the table is itself difficult to achieve. For football stadiums which hold a maximum of 30 matches per year, an artificial pitch is without a doubt a very heavy investment indeed.

A natural grass field, strengthened with fibres, suitable for 500 to 700 hours' use per year (match and training) will need an investment of about 255,000 euros (£173,000). One hundred per cent natural grass fields with a capacity of up to 500 hours are much cheaper and vary in price – between 70,000 and 140,000 euros (£48,000 and £95,000). It is clear that artificial turf is a more expensive investment.

A lifespan of 15 years is often calculated for the synthetic top layer, but so far nobody has had this kind of field for this number of years. The feeling in the industry is that a maximum of 10 years is a more realistic time scale. This increases the annual costs considerably. The maintenance costs of an artificial pitch, calculated by manufacturers, look rather optimistic. Some people working on artificial pitches are already facing unexpected maintenance work, and this has significantly increased costs.

In many competitive overviews by artificial turf manufacturers, the maintenance costs for natural turf pitches are calculated at too high a level. An amount of 5,000 to 15,000 euros (£3,000 to £10,000) is a realistic figure. The costs for natural grass pitches depend a lot on the intensity of use and also on the skill of the groundsman. Due to the introduction of improved grass varieties and new species, it is now possible to make significant savings in the maintenance costs of natural grass pitches. For artificial pitches, the annual maintenance cost also falls between 5,000 and 15,000 euros (£3,000 to £10,000) per field per year.

When natural grass pitches have to be renovated or re-seeded, the top layer is often used for making compost. In fact, the costs involved are negligible. For artificial turf or combined pitches it's a very different story! Recycling the fibres and the rubber costs money, and the processes involved cause serious environmental problems. Recycling artificial turf costs about 10 euros (£7.00) per m^2. For a total artificial field (7,500 m^2) this will mean 75,000 euros (£51,000)!

It is a fact that four of the five UEFA artificial pilot pitches recently installed had to be replaced because they were sub-standard. This is a huge waste of money. Moreover, football clubs and local authorities which have bought similar products now own pitches which probably don't meet the highest quality standards. The question is, are these pitches going to make the predicted lifespan of 10 years? If not, their annual cost will increase considerably.

Figure 3 – Comparison of investment and maintenance costs for natural grass versus artificial grass pitches

	Natural grass	*Combined natural grass + artificial grass*	*Artificial grass*
Type	Normal	Grass + 3% artificial grass	Rubber infill
Number of playing hours	400	700	900 – 1300
Investment costs	70,000 – 140,000 € (£48,000 – £95,000)	200,000 – 250,000 € (£136,000 – £170,000)	500,000 – 600,000 € (£340,000 – £408,000)
Lighting investment costs	40,000 € (£27,000) not necessary for each pitch	40,000 € (£27,000) necessary for each combined pitch	40,000 € (£27,000) necessary for each artificial pitch
Fencing costs	15,000 € (£10,000) not necessary	15,000 € (£10,000) Necessary	15,000 € (£10,000) necessary
Maintenance costs	5,000 – 15,000 € (£3,000 – £10,000)	6,000 – 15,000 € (£4,000 – £10,000)	5,000 – 15,000 € (£3,000 – £10,000)
Electricity costs 350 hours, 8 lamps x 25.2 kW x 0.085 E	None	6,000 € (£4,000)	6,000 € (£4,000)
Interest costs 6%	4,200 – 8,400 € (£2,800 – £5,700)	12,000 – 18,300 € (£8,000 – £12,400)	33,000 – 40,000 € (£22,000 – £27,000)
Lifespan top layer = 60% of investment	15 – 25 years	15 – 25 years	10 – 15 (?) years
Lifespan	15 – 25 years	15 – 25 years	30 years
Depreciation costs	3,500 – 7,000 € (£2,300 – £4,700)	12,750 – 15,250 € (£8,670 – £10,370)	55,500 – 42,575 € (£37,750 – £28,960)
Recycling costs	None	10 €/m² = 75,000 € (£7/m² = £51,000)	10 €/m² = 75,000 € (£7/m² = £51,000)
Total annual costs	**12,700 – 30,400 € (£8,640 – £20,680)**	**36,750 – 54,550 € (£25,000 – £37,109)**	**99,500 – 103,575 € (£67,690 – £70,460)**
Total annual costs per playing hour	**31.75 – 76.00 € (£21.60 – £51.70)**	**52.50 – 77.93 € (£35.70 – £53.00)**	**79.67 – 110.55 € (£54.20 – £75.20)**

Other economic aspects

FIFA states: "FIFA is responding to the growing demand for playing football on artificial turf, chiefly in regions where the climate makes it impossible to organise football matches on good natural turf all year around." (Source: FIFA quality concept for Artificial Turf).

This seems reasonable, but it's more complicated than that. In artic areas, a pitch heating system is necessary to keep the pitch free from snow and ice. This means huge extra investment and maintenance costs. Are professional clubs and local authorities willing to pay for this? For spectators it's no fun watching football in temperatures way below zero.

In arid and hot climates an artificial pitch might look like an interesting solution, but (good quality) water is needed to cool down the pitch and to keep it playable. So extra investment is needed for irrigation equipment. The question is, do people in hot climates need drinking water for survival or for playing football? A natural grass pitch covered with adapted (tropical) grass species is a good alternative, and is certainly much cheaper.

The beautiful game

Playing aspects – perception of players

Polls among professional football players have revealed some interesting results. It is clear that natural grass is preferred by the majority of players (Source: VVCS and FIFpro, Netherlands).

Statements supporting this have also appeared in a Dutch newspaper (Gelderlander 12/3/05), and recently a player Marc Hegeman, who played for Heracles Almelo on artificial turf, stated: "We players were ordered to respond positively to any questions about artificial turf." (Source: Dagblad vh Noorden 28/1/06).

Among amateur players, a small number prefer playing on artificial grass, but this is mainly influenced by their bad experiences with poorly maintained natural grass pitches.

Despite the benefits of artificial pitches (smooth surface, less influence from weather conditions), players come up with the same remarks about artificial turf time and time again:

Rafael van der Vaart, a former player for Ajax Amsterdam, said after playing on artificial turf: "This artificial grass was a disaster. It hurt my feet. I really hope we don't get this in the Amsterdam Arena. If this is the future, I'd better stop playing football." (Source: regional newspapers Holland).

Arno Arts, VVV-Venlo: "Playing football on artificial grass can't be compared with playing on natural grass. I didn't like it at all and in my team 8 out of 10 players have the same opinion." (Source: regional newspapers Holland).

Bram Marbus, Go Ahead Eagles, Deventer: "I didn't enjoy it. It is rough and I got pain in my knees and ankles. It has nothing to do with grass!" (Source: regional newspapers Holland).

Thomas Hässler, Team manager, Salzburg Austria (UEFA test stadium for artificial turf): "Every player I know wants to play on natural grass. Personally I am looking forward to every away match." (Source: regional newspapers Holland).

Patrick Lodewijks, keeper Feyenoord Rotterdam: "I will certainly be the last keeper who plays professional football at the age of 40, because with artificial grass, keepers have to stop when they are 34 due to worn out hips." (Source: Algemeen Dagblad, National newspaper in Holland from 26/1/06).

Players also talk about the smell of grass, making slides on wet natural pitches, etc. and some people think this is just nostalgia. But football is all about emotion. That's the game!

Picture – courtesy of Lee Jackson, Manchester City Football Club.

Ball response

On natural grass the ball response is optimal – the right speed, the ball spin and bounce. Only a very badly maintained pitch can have a negative influence on the response of the ball. According to one of the FIFA laboratories (ISA, Holland) it will be very difficult to achieve the same ball response on artificial grass. The question is, can these problems ever be solved?

Characteristics of the match

By playing football on artificial grass, the game will change considerably and will move towards indoor football. Is that really what spectators want?

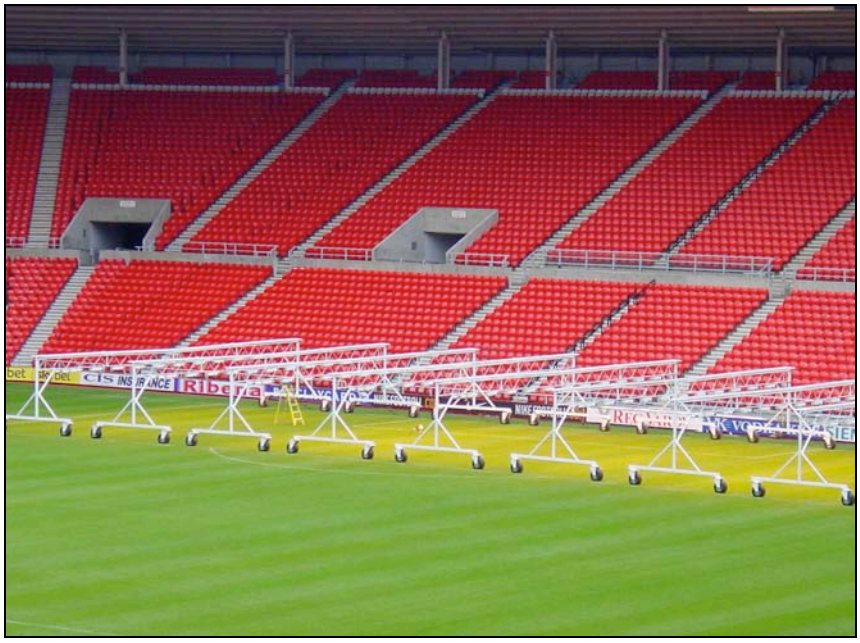
To make a comparison between hockey and football would be wrong, because a hockey ball is much more influenced by the surface quality of the pitch. A football doesn't behave like this. Moreover, football is a contact sport, but hockey is just the opposite. For these reasons, it could be said that artificial grass is a blessing for hockey, but the same can't be said of football.

Natural grass strikes back with excellent alternatives!

It is true that the natural turf industry didn't produce a quick solution to the new problems which occurred on sports parks (too many players on a limited number of pitches), and in football stadiums (shade, multi-functional usage, roofs). But this has now changed, putting natural turf firmly back in the spotlight. Excellent new products have come on the market that enable groundsmen from local authorities and sports stadiums to maintain a superb quality natural pitch all year round.

Artificial lighting systems

A company in the Netherlands has developed a concept which lets grass grow all year round, even during the winter. This concept is an excellent aid to natural turfgrass in stadiums. It has been installed at PSV Eindhoven, SC Heerenveen, Newcastle United, Sunderland (pictured below) and last but not least, Arsenal. The results are very impressive. Mowing the pitch twice a week during the winter! Who would have believed this was possible five years ago? (Source: SGL www.sglconcept.com).



New grass species, varieties and mixtures

With the introduction of new species such as Tall Fescue, Poa and Deschampsia, shade problems in stadiums can be very effectively tackled. Newly released varieties of perennial ryegrass and smooth-stalked meadowgrass offer better sod density, improved wear tolerance and persistency. Also, a prolonged growing season of these species contributes to a better performance of the natural grass during the worst periods for grass growth during the year.

Breeders put a great deal of investment into developing better mixture formulations in order to offer the finest quality mixtures to the sports market. The availability of new species and varieties has resulted in major improvements, which has been a resounding success with both groundsmen and players.

Maintenance schemes

New mixtures and technologies require different pitch maintenance. Joint efforts from grass breeders, the fertilizer industry, pitch constructors, machinery manufactures and groundsmen's organisations have led to better adapted maintenance schemes for natural turf under all circumstances. Due to new technology and increased knowledge, it is now possible to better advise groundsmen in order that they can maintain the highest quality pitches throughout the playing season.

Concluding statement

In this report, the Section Forage Plants and Amenity Grasses of the European Seed Association has shown there *is* a place for artificial turf in the sports industry. However, there are many serious factors to consider before deciding to purchase a natural or artificial pitch for construction or reconstruction.